INTERGRAPH®
Smart → 3D

HVAC
User's Guide

PART OF
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Contents

Preface

This document is a user's guide for the HVAC functionality of Intergraph Smart™ 3D and provides command reference information and procedural instructions.

Documentation Comments

For the latest support information for this product, comments or suggestions about this documentation, and documentation updates for supported software versions, please visit *Intergraph Smart Support* (*https://smartsupport.intergraph.com*).

What's New in HVAC

The following changes have been made to the HVAC task.

Version 2016 (11.0)

- Added a new locate filter, **Construction Graphics**. For more information, see *Select objects* (on page 13). (P2 CP:271166)

- Added a new **Quick Route** ▐▌ command that enables you to join two existing duct segments. For more information, see *Quick Route* (on page 71). (P1 CP:248716; P1 CP:248717; P3 CP:288004)

- You can now set the software to remember the last used working plane when routing duct. For more information, see *Defaults Tab (Duct Properties Dialog Box)* (on page 107). (P4 CP:258470)

- You can now move or delete at boundary connections maintaining the ducting design intent. For more information, see *Appendix: Deleting at Boundary Connections* (on page 88) and *Appendix: Moving at Boundary Connections* (on page 83). (P2 CP:249685, P2 CP:267185, P2 CP:268379, P2 CP:264940, P2 CP:248568, P2 CP:300832)

- You can select a section of ducting network using the new route selection commands. For more information, see *Route Selection Commands* (on page 41). (P1 CP: 248690, P2 CP:293434, P1 CP:297357)

- You can slide a branch leg along a header run without disconnecting the branch. For more information, see *Move a branch along the header* (on page 33). (P2 CP:293434)

- Added a new **Disconnect** command that allows you to disconnect route objects without disturbing the rest of the network. For more information, see *Disconnect Command* (on page 79). (P2 CP:293435)

- You can now select a straight feature on a run, and move it to connect to an adjacent run. For more information, see *Modify a set of features* (on page 33). (P2 CP:300832)

HVAC

The HVAC task creates a three-dimensional representation, or model, of a distributed system so that you can create a fully rendered 3-D model of various duct systems. You use a combination of parts and features, objects that define the geometry and design intent of a run, to model the duct runs that comprise the duct system. In the software hierarchy, a feature is a child to a run and a parent to a part. Features are not displayed in the Workspace Explorer because of their ability to own several parts. In addition to duct modeling commands, the HVAC task provides a command for creating spools. Start this task by clicking **Tasks > HVAC**.

The following illustration shows the relationships between the pieces of a duct system.
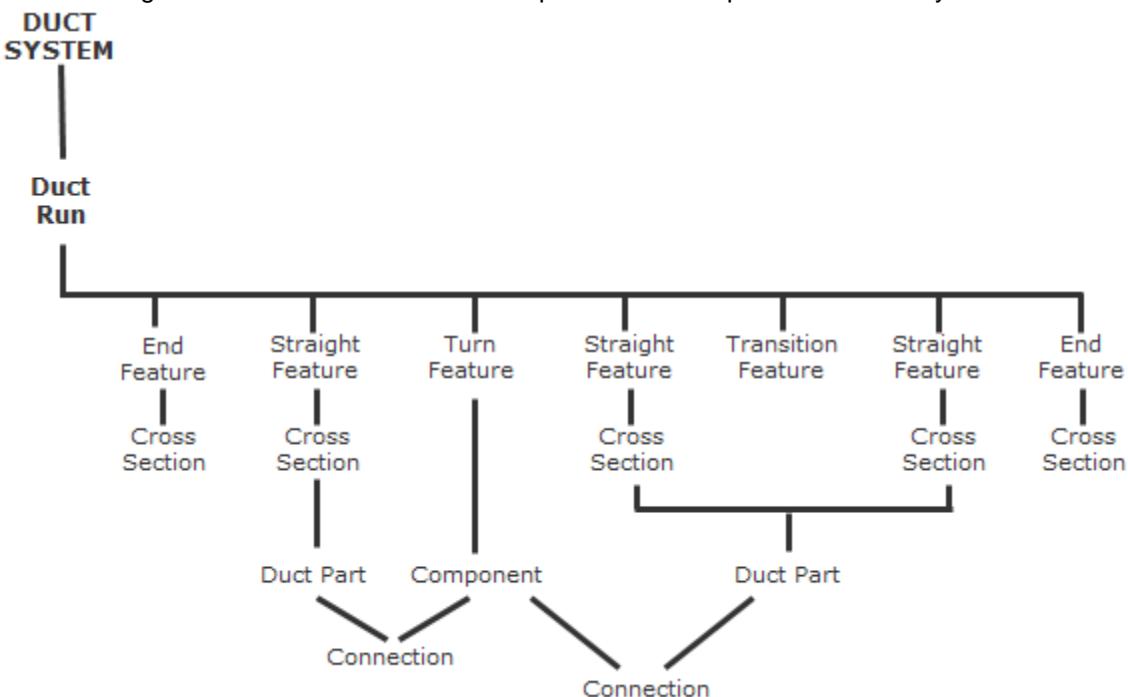
Duct Systems

A duct system is a way of organizing duct runs within the system hierarchy and controlling the specifications that can be used within that system. If a duct system exists in your model, you can route duct runs and arrange the duct runs as children in the system hierarchy.

Duct Runs

A run is a collector of features and parts, and is typically a child of a duct system in the Workspace Explorer. It also provides the Catalog specification from which you can choose the parts. Duct run is a duct path with the same specification, material, and values of maximum recommended velocity and pressure loss.

Duct Features

A feature is a modeled portion of a duct run consisting of one or more parts. Examples

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include a turn or a branch. Duct modeling features add functional capabilities to your duct run. You create them during the routing process by inserting splits and components to meet particular design needs or constraints. By placing such objects during the routing process, the software presents a more accurate model of the final design, without needless, extensive editing of the duct system. The duct features are not listed in Workspace Explorer.

During routing, you select the needed command and the software immediately suspends routing while determining the properties and placement of the feature. When the feature is finished, the software returns to the routing process. You can also insert features after the route is completed. After you draw a duct run, you can mouse hover on various features and a tooltip shows the feature type. If you select the feature, a horizontal ribbon specific to that feature type displays. Because the ribbons are specific to a feature type, the available options change.

You can use the fields on the ribbon to modify the features or you can click **Properties** 📑 on the horizontal ribbon to open the corresponding properties dialog box. You can also click **Edit > Properties** from the menu bar or select **Properties** from the context menu. To open the context menu, right-click on the feature.

Leg

A leg is a group of route features routed in the same direction.

Duct Part

A duct part is a physical component that comprises a feature and is generally selected by the software. The following illustration shows some examples of duct parts that represent a portion of a duct system. The highlighted portion of the figure shows a section of the **Workspace Explorer** containing the hierarchy of duct parts.
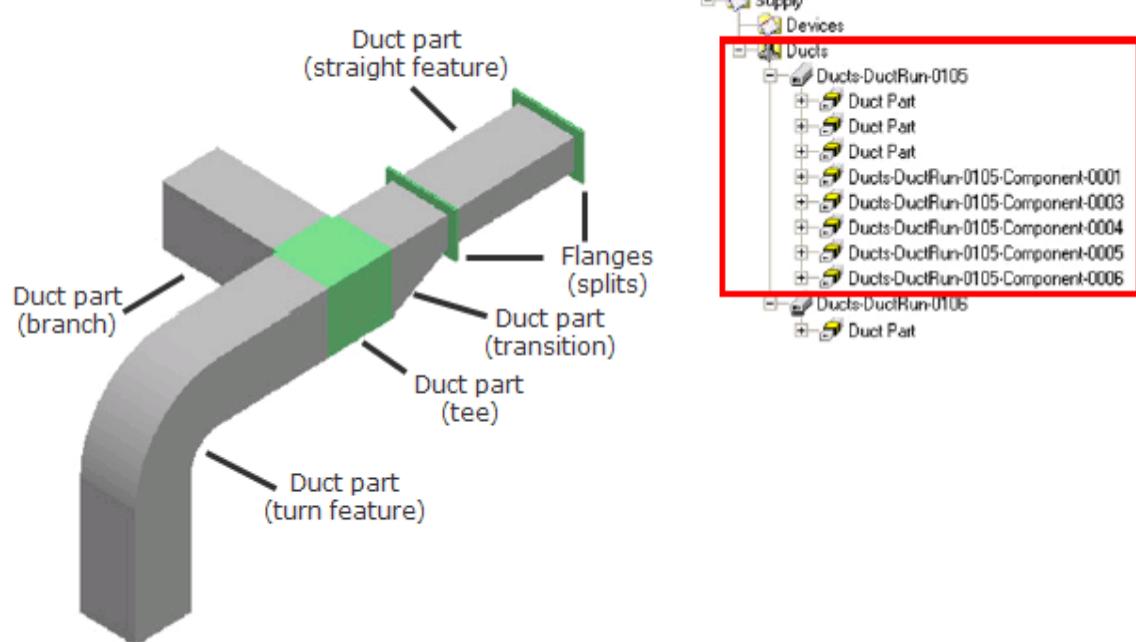
Cross Section

The path feature of the duct is linked to a cross-section that is used to define the shape of the duct. These cross-sections provide an outline of the shape of the duct, while the feature

provides the geometry path.

Component

In-line and surface-mounted parts such as heaters, gauges, and access panels to your HVAC system. When you select a nozzle or component end, the software sets the cross section of the duct to match the cross section and orientation of the nozzle or component. Two modes of operation are available when you insert a component, standalone and routing.

- **Standalone Mode** - Places a component independently without using other commands. This mode starts when you insert a component in a straight feature or at an end feature of a completed duct run.

- **Routing Mode** - Works in conjunction with the **Route Duct** command. After you have started the **Route Duct** command, you start the **Insert In-line Component** command and place the component at the active point. The **Route Duct** command remains active.

Connection

A connection is an object that connects two parts, for example, a flange and a duct part. The following illustration shows the details of a nozzle connection:
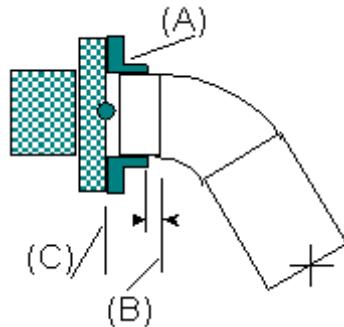
(A) - Flange (connection)
(B) - Minimum straight length
(C) - Welding gap

Boundary

A boundary is a port of the terminal object in a select set. Boundaries can exist at line change, run change, branch point, and split.

Equipment

Equipment may have one or more HVAC nozzles through which the connections to the duct systems are made. Using the Equipment task, HVAC equipment like fans, chillers, and air handling units can be modeled directly in the model or can be placed from the Catalog if they are available in your project.

HVAC Nozzle

An HVAC nozzle is the connect point between duct parts and equipment. It contains definitions of the connection like flow direction, duct cross-section, and size.

The vertical toolbar on the left side of the window contains tools that you use to route the HVAC system. The **Select** tool allows you to quit all active commands and select an object that you want to review or modify. After you place a section of ducting, you then can

modify the run with several commands, for example,

- Inserting split features or splitting one line into multiple runs.

- Modifying the size of the existing run by inserting a transition feature.

- Adding components to represent a complex composition of the run. For example, in-line components and surface-mounted components.

Tools and Commands

The vertical toolbar on the left side of the window contains tools that you use to route the HVAC system. The **Select** tool allows you to quit all active commands and select an object that you want to review or modify. After you place a section of ducting, you then can modify the run with several commands, for example,

- Inserting split features or splitting one line into multiple runs.

- Modifying the size of the existing run by inserting a transition feature.

- Adding components to represent a complex composition of the run. For example, in-line components and surface-mounted components.

The HVAC task includes the following commands:

	Select - Selects objects in the model so that you can copy, move, modify or delete the objects.
	Route Duct - Creates a new duct run, extends an existing run, routes to or from nozzles or end features, and creates branches from duct runs. If you select an end feature before starting the command, that feature is the default starting point for the new duct run. For more information, see *Route Duct* (on page 20).
	Insert Split - Cuts a duct into two, or more, segments and inserts a split feature to connect the ends. You can insert a split between straight and non-straight features, and between non-straight features, such as turns. You can start the **Insert Split** command without finishing the **Route Duct** command. That is, you can split parts and then continue routing the duct. If you end the **Route Duct** command so that the split feature and end feature are in the same location, the software automatically deletes the split feature. For some split types, you need to use **Depth Slope** to orient the split correctly. For more information, see *Insert Split* (on page 44).
	Insert Transition - Adjusts the duct to accommodate a change in shape by placing and modifying a transition feature. You can create a transition feature only on an existing end feature or HVAC port. If you select an end feature or nozzle before starting this command, the software inserts the transition at that point. If you insert a transition during the routing of a duct run, clicking **Finish** returns the software to routing the duct at the end of the transition feature. Click **Properties** on the horizontal ribbon to set the properties of the transition feature at any time during the command. For more information, see *Insert Transition* (on page 49).

📙	**Insert In-line Component** - Places components that the software did not place automatically during routing. These components can include straight features, end features, cross sections, and so on. However, this command cannot place hoods, terminal boxes or plenums, which are enclosures or chambers that contain gas at a higher pressure than the surrounding atmosphere. Place these components as equipment in the Furnishings and Equipment task. Click **Properties** on the horizontal ribbon at any time to set the properties of the in-line component. For more information, see *Insert Inline Component* (on page 56).
📝	**Insert Surface Mount Component** - Places surface-mounted components at the location and rotation that you want. When you select a feature before clicking the command, the component appears on the selected feature; however, you can type precise values for the component location using the **Reference position** and **Offset** boxes on the ribbon. Also, you can make changes to the horizontal ribbon to further define the component. You can click **Properties** on the horizontal ribbon at any time to set the properties of the surface-mounted component. For more information, see *Insert Surface Mount Component* (on page 61).
📊	**Generate Spools** - Defines a spool, or fabrication assembly, for the selected ducting. For more information, see *Generate Spools* (on page 65).
⊢•⊣	**Quick Route** - Joins two existing duct segments in the model. For more information, see *Quick Route* (on page 71).
	Tools > Flow Calculator - Provides a tool for you to complete partial calculations to choose the cross section or to estimate the flow rate. For more information, see *Flow Calculator* (on page 93).

Select objects

All objects in the HVAC task have properties that you can edit. Using the **Select** ▷ command on the vertical toolbar, you select the object that you want to edit.

An important part of the **Select** command is the **Locate Filter** box that appears on the ribbon. The **Locate Filter** box contains the available, predefined filters for the **Select** command. When you choose a filter in the **Locate Filter** box, the software allows you to select only the filtered objects in a graphic view and in the **Workspace Explorer**. For example, if you select **Duct Runs**, you can select only duct runs in a graphic view or in the **Workspace Explorer**.

The HVAC task includes these filters:

Connections

Allows you to select HVAC connections.

Construction Graphics

Limits the selection of items to construction graphics.

Control Points

Limits your selection in a graphic view or in the **Workspace Explorer** to control points created using **Insert** > **Control Point**.

Duct Features

Allows you to select objects that are editable in the HVAC task.

Duct Parts

Allows you to select ducting and component parts.

Duct Runs

Allows you to select entire duct runs.

Duct Spools

Allows you to select duct spools.

Equipment

Allows you to select equipment components.

HVAC Nozzles

Allows you to select HVAC nozzles.

Use the **Inside fence** command to select all objects entirely inside the fence.

Use the **Inside/Overlapping fence** command to select all objects entirely inside the fence and those objects outside but touching the fence at some point.

Apply a filter

1. Click **Select** .

2. In the **Locate Filter** box on the ribbon, select the filter for the objects to locate.

3. Select multiple objects using a fence or by using the Windows keyboard shortcuts CTRL or SHIFT.

Duct Features

You use the following features to create a duct run:

Straight Feature

The path of this feature describes a straight line. This feature is defined by two linear data points from a user. Basic geometric principles dictate that two points define a line, thus the straight section of a duct run is a straight feature, as shown in the following illustration.

End Feature

This feature acts as a place holder for future connections to the run. It is located at the end of a run, where a port exists on a part that is managed by the run. When an end feature is connected to a run, it is removed and replaced with another feature, based on the nature of the addition to the run. An end feature represents either end of a physical duct run. When you change a cross section, the software automatically inserts a transition feature. Also, when you change routing direction, the software automatically inserts or changes the turn feature. You can type a value in the **Angle** box only if the specification is set for continuous angle type.

Transition Feature

A transition feature represents a change in the cross section of the duct run. The path of this feature is defined by a transition between cross sections or sizes or other defining constraints that result in the first port of the part being fundamentally different from the second port. The result is a feature that must close the gap between these parts. The transition feature modifies the cross-section of a duct run. It allows you to change a duct to all possible combinations. Ducts use transitions to connect different segments of the duct run that have different dimensions or shapes. The default transition feature has cross sections that either you specify manually or the software defines by default. The feature type is concentric or centerline-aligned. The default values for these properties originate with the selected end feature or nozzle where you are inserting the transition. If you did not select an end feature or nozzle before the Insert

The following illustration depicts the rule that defines the length of the default transition feature:
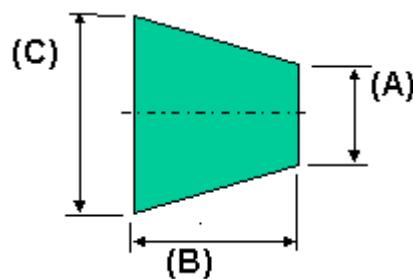
(A) - W2 or the value of the second width in the default transition feature

(B) - L or length in the default transition feature; to determine the length, subtract the second length from the first length; then divide the difference by the tangent of the transition wall angle; in algebraic form, the equation is $L = (W1 - W2) / \tan x$ (where x is equal to the transition wall angle)

(C) - W1 or the value of the first width in the default transition feature

Turn Feature

This feature represents a deviation in a path resulting in a turn. Turn features, such as elbows, miter elbows, and gooseneck elbows, change direction of the duct. If the centerline of the active duct is not collinear with the existing duct, the software automatically inserts the turn feature at both duct ends. If the two ducts are collinear, the software merges the two sections into one section. The default turn feature has the same cross sections on both ends. An administrator can edit the reference data to add values to display as options in lists on the ribbon.

Properties for turning vanes and branch vanes in turn features and branch features appear on orthographic drawings but are not needed for the model. The property names are Number of Vanes and Vane Length, and you need to type the values for these properties. The vane material, vane thickness, and vane width are the same as the parent feature. If you modify a feature with vanes, the software automatically recalculates the vane length, part weight, and part center of gravity.

An example would be three data points provided by a user. The first two data points generate a straight feature. The third data point, if not in-line with the first set, constitutes a deviation in path from the existing straight projection, as shown in the following illustration.
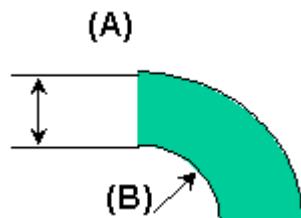
(A) - Uses a width ratio (depth divided by width) to calculate the turn radius for a rectangle

(B) - Uses a width ratio (depth divided by width) to calculate the turn radius for a flat oval

Split Feature

This feature represents a break and a joint in the duct. It divides a duct along a straight section into two straight features to connect the ends of the two ducts at the cut location, such as butt welding, coupling, flange set, and joint sleeve. A split feature is specific in its design by representing a break and a joint in the ducting. Examples are a sleeve, weld, and a flange set, either sloped or flat. These examples also are called split parts, which the software reads from the reference data.

Branch Feature

This feature represents junctions whose path is defined by branching components, such as tees, wyes and crosses. The location that you select can be on the duct surface for a square cross section or the centerline of the duct for a round cross section. When you locate the point on a duct surface, by default the software aligns it with the centerline of the duct. The third port of a branch feature will always, by rule, constitute a new run that is independent of the header connections. When you change routing direction, the software automatically changes the branch surface.

If you modify a feature with vanes, the software automatically recalculates the vane length, part weight, and part center of gravity. Properties for turning vanes and branch vanes in turn features and branch features appear on orthographic drawings but are not needed for the model. The property names are Number of Vanes and Vane Length, and you need to type the values for these properties. The vane material, vane thickness, and vane width are the same as the parent feature.

Along Leg Feature

This feature represents in-line components such as dampers or filters where port 1, the origin, and port 2 are collinear.
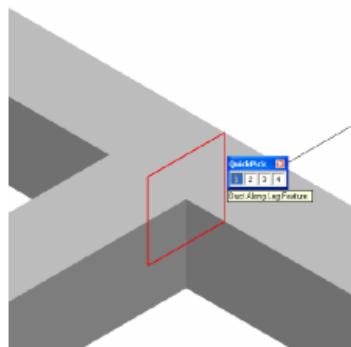
Rules for copying and pasting features

You can paste or place objects along a straight feature, and at end features, component ports, and equipment ports. Duct, cableway, and conduit objects also are available to copy and paste.

The main restriction that exists among the routings tasks concerns activity within the same task. For example, you can only paste a conduit object within a conduit run. Similarly for HVAC and Electrical, you only can paste duct objects within a duct run, or cableway objects within a cableway.

When you copy an object, you can paste it into an existing run. The data associated with the specification, cross section, and dimensions does not change. The software inserts transition features or mating objects to resolve differences in the composition of the model.

When you copy cross section shape and size, the software maintains the same dimension as the original section. The software inserts transitions for cableway and duct runs, and inserts reducers for conduit to compensate for different shapes or sizes.

The following graphic demonstrates the processing during pasting a copied object:
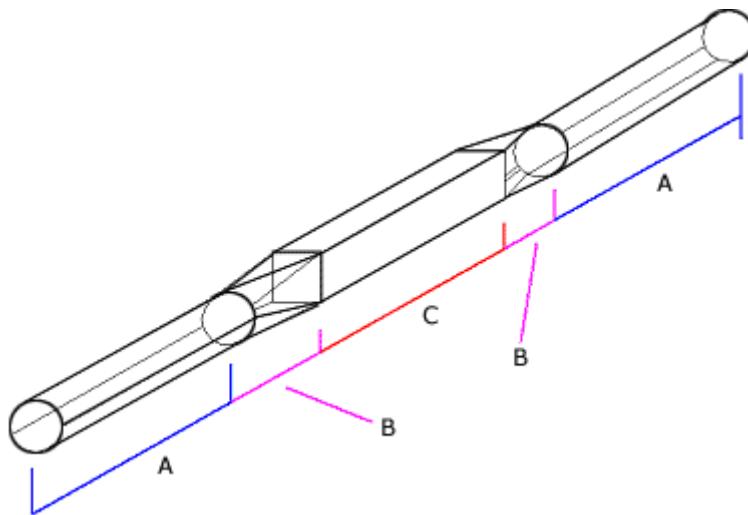
(A)   Original duct run

(B)   Transition that the software inserted at connection

(C)   Duct that you copied and pasted

Rules for moving features

After you complete a duct run, you can move the features of that run. By moving the features, you can alter the route of the duct, connection points, or component placement. Using this ability to move features of your duct runs, you can precisely locate each feature in the layout of your HVAC systems.

You can move route objects by selecting one or more features using **Move** ✛ on the main ribbon bar, or using the **Move From** ↗ and **Move To** ↗ commands on the modify feature ribbon bar. We recommend that you use **Move** ✛ to move large sections of network to maintain the connectivity. Use **Move From** ↗ and **Move To** ↗ to move a feature.

You can only move a route object if:

- you have Full Control or Write access to the permission group the object belongs to,
- the object's **Approval Status** is **Working**.

The various types of features that you can move in this method include:

Straight Features

The straight feature and other connected route features move subject to the following rules:

- Moving the straight feature moves the entire leg to which the feature is connected.
- The move direction is always perpendicular to the axis of the straight feature.
- The end of an adjacent leg not in the plane of motion is modified to connect to the new position of the moved leg.
- A branch feature connected to the moved leg maintains its original angle.
- Movement stops when parts on the associated leg overlap, or when they overlap with adjacent parts on connected legs.
- When equipment moves, the leg moves with the equipment nozzle to remain collinear with the nozzle as much as possible.

Turn Features

The turn feature and other connected route features move subject to the following rules:

- If the branch and header are in the motion plane, the along leg feature-branch parent function and the branch feature move along the branch leg.
- If the branch and header are not in the motion plane, the end of the branch leg, the along leg feature-branch parent function, and branch feature move to keep the branch angle constant.
- Along leg features that are not branches maintain a position at a constant distance from the fixed end of the leg.
- If you move a turn to a position where two adjacent legs are collinear (that is, the turn reaches 180 degrees), the software deletes the turn.
- The turn stops moving when it starts to overlap with an adjacent along leg feature.

End Features

The end feature and other connected route features move subject to the following rules:

- Moving the end feature edits the end feature and the length of the straight feature on its leg.
- Moving the end feature edits the topology, or layout of the surface, of the turn feature or the branch feature if connected to another leg. The default motion plane is the connected turn feature or along leg feature with branch parent function.
- You cannot move an end feature connected to a nozzle.
- You must end the move when the end feature touches a nozzle or free port of the base part of a feature other than a straight feature (when the straight feature length is reduced to zero).

Branch Features

- You cannot move branch features. You can move the branch parent feature only.

Branch Parent or Run Change Features

The branch parent or run change feature and other connected route features move subject to the following rules:

- You can move the branch parent feature or run change feature along the associated straight feature. As you move the branch parent feature, the angle between the branch parent feature or run change feature and the branch leg appears in a dynamic readout. The angle is not applicable for run change features.

- The size of the run change header connections is determined by the size of the connected straight feature, and therefore you cannot change the size independently.

- You can move features only after you finish routing a duct run and placing components. Edit commands are not available until you complete routing or placement.

S ECTION 2

Route Duct

Creates a new duct run, extends an existing run, or routes to or from nozzles or end features. If you route to or from a straight feature, the software creates a branch, including all matching parts and fittings, and defines the working plane based on the plane of the branch. If you route to or from an end feature, the software extends the previous run and sets the working plane.

Route Duct Ribbon

Sets options for routing a duct run. The ribbon displays different options based on the duct shape, including rectangular, flat oval, and round.

Properties

Displays the **Duct Properties** dialog box. For more information, see *Duct Properties Dialog Box* (on page 106).

Start Route

Click to specify the starting location of the duct run.

End Route

Click to specify the point to end the duct run.

Plane

- ◇ **Plan Plane**

  Defines the work surface as the XY plane at the depth of the active end. You also can press CTRL+1 to select this option.

- **Elevation Plane: East-West** (**Z Plane: X-Axis)**

  Defines the work surface as the XZ plane. You also can press CTRL+2 to select this option.

- **Elevation Plane: North-South** (**Z Plane: Y-Axis)**

  Defines the work surface as the YZ plane. You also can press CTRL+3 to select this option.

- **Plane by Turn/Branch**

  Defines the work surface as the plane defined by an existing turn or branch. You select the turn or branch to set the plane. You also can press CTRL+4 to select this option.

- ▷ **Plane by Three Points**

  Defines the work surface using three points that you define. You also can press CTRL+5 to select this option.

- ▪ ✖ **No Plane**

  Clears any work surfaces. The software does not project points that you place to any plane. You also can press CTRL+6 to select this option.

Run

Displays a list containing all existing runs in the same system as the run that you last placed. If you select an existing duct run from the list, the software activates that run. The **New Duct Run** option opens the **New Duct Run** dialog box. The **More** option opens the **Select Duct Run** dialog box.

Shape

Defines the offset cross-sectional shape. When you change the cross-sectional type, the dimension boxes display different values.

- ▪ If you select **Rectangle** 🖳, the available dimension properties are **Width, Depth**, **Radius**, and **Orientation**.

- ▪ If you select **Round** 🔾, the available dimension properties are **Diameter, Length**, and **Offset**.

- ▪ If you select **Flat Oval** 🔾, the available dimension properties are **Width**, **Depth**, **Orientation**, **Length**, and **Offset**.

Width

Defines the width dimension of the cross section. This option is available only if you have selected **Rectangle** or **Flat Oval** in the **Shape** box.

You can enter only values that are greater than or equal to the depth value, if defined. Values stored in the reference data determine the list of options. The list displays only the values that are valid for the current depth. If the depth is not defined, or the **Depth** box is blank, the width size is based on the default width ratio.

Depth

Defines the depth of the cross section. This option is available only if you have selected **Rectangle** or **Flat Oval** in the **Shape** box. The list of options is determined by the values stored in the reference data. The list displays only the values that are valid for the current width. If the width is not defined, or the **Width** box is empty, the depth size is based on the default width ratio.

Radius

Defines the radius of the cross section. This option is available for rectangular shapes. The corner radius box is not active until you define both a width and a depth. If you change width or depth, the software updates the list to contain the allowed values for that combination of width and depth. If the reference data cannot accept the width, depth, or both, you must type a radius. The **Radius** box is not available if you select an end feature or nozzle to position the offset, because this action determines the cross section shape and size of the offset cross section. This option is available only if you have selected **Rectangle** in the **Shape** box.

Diameter

Defines the diameter only for shapes that you assign as **Round**.

Orientation

Defines the angle between the local axis and width axis of the duct run.

Angle Lock

Locks or unlocks the **Angle** box.

Angle

Defines the angle for the current route segment. If the **Angle Lock** is unlocked, the box displays a dynamic readout of the current bend angle.

Length Lock

Locks or unlocks the **Length** box.

Length

Defines the length for the current route segment. If the **Length Lock** is unlocked, this box displays the dynamic readout of the current route segment length.

Offset

Defines the offset of the part surface from the working plane. The offset reference options are centerline and largest surface.

Edit Duct Run Ribbon

Reviews and modifies duct run properties.

Properties

Displays a dialog box with properties for the selected duct run. Allows you to review the properties of the selected run and change the values assigned to a property.

Duct run

Defines the name of the duct run.

System

Defines the system that the duct run belongs to. Click **More** to assign it to a different system.

Shape

Defines the offset cross-sectional shape. When you change the cross-sectional type, the dimension boxes display different values.

- If you select **Rectangle** , the available dimension properties are **Width**, **Depth**, and **Radius**.

- If you select **Round** , the available dimension property is **Diameter**.

- If you select **Flat Oval** , the available dimension properties are **Width** and **Depth**.

Rectangle

Width

Defines the width of the duct run.

Depth

Defines the depth of the duct run.

Radius

Defines the corner radius of a rectangular duct run.

Round

Diameter

Defines the diameter of the duct run.

Flat Oval

Width

Defines the width of the duct run.

Depth

Defines the depth of the duct run.

Orientation Angle

Sets an angle between the local axis associated with the cross section and the width axis. If the angle value is zero, the width is aligned with the local cross section axis.

The following picture shows the orientation angle (C).

(A) - Cross section
(B) - Width axis
(C) - Orientation angle
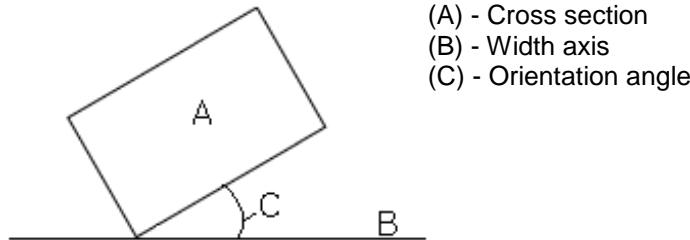
Edit Straight Feature Ribbon

Reviews and modifies straight features.

Properties

Opens a dialog box with properties for the selected feature. Allows you to review the properties of the selected feature and change the value assigned to a property.

Move From

Defines the origin of the move vector. If you do not define a starting point, the current location of the straight feature is assumed to be the starting point.

Move To

Defines the termination point of the move vector.

Plane

- **Plan Plane**

  Defines the work surface as the XY plane at the depth of the active end. You also can press CTRL+1 to select this option.

- **Elevation Plane: East-West (Z Plane: X-Axis)**

  Defines the work surface as the XZ plane. You also can press CTRL+2 to select this option.

- **Elevation Plane: North-South (Z Plane: Y-Axis)**

  Defines the work surface as the YZ plane. You also can press CTRL+3 to select this option.

- **Plane by Turn/Branch**

  Defines the work surface as the plane defined by an existing turn or branch. You select the turn or branch to set the plane. You also can press CTRL+4 to select this option.

- **Plane by Three Points**

  Defines the work surface using three points that you define. You also can press CTRL+5 to select this option.

- **No Plane**

  Clears any work surfaces. The software does not project points that you place to any plane. You also can press CTRL+6 to select this option.

Run

Defines the name of the duct run associated with the straight feature.

Shape

Defines the shape of the duct. The shape you select determines the other controls that display on the ribbon.

Rectangle

Width

Defines the width of the feature.

Depth

Defines the depth of the feature.

Radius

Defines the corner radius of a rectangular duct.

Round

Diameter

Defines the diameter of the feature.

Flat Oval

Width

Defines the width of the feature.

Depth

Defines the depth of the feature.

Orientation

Defines the orientation of the straight feature. A value of 0 results in a straight feature with the width horizontal and the depth vertical. A value of 90 degrees results in the width vertical and the depth horizontal. The value for an angles ranges from 0 to 360 degrees.

Length Lock

Turns on or off locking for the length of the leg. If the length is locked, then you cannot change the length value.

Offset

Defines the distance for offset that the software uses during feature placement. The reference is centerline, width, or depth). The route plane does not have to be active to locate the offset from the plane point.

Edit Turn Feature Ribbon

Reviews and modifies turn features or components.

Properties

Opens a dialog box with properties for the selected feature. Allows you to review the properties of the selected feature and change the value assigned to a property.

Move From

Defines the origin of the move vector. If you do not define a starting point, the current location of the turn is assumed to be the starting point.

Move To

Defines the termination point of the move vector.

Plane

- **Plan Plane**

  Defines the work surface as the XY plane at the depth of the active end. You also can press CTRL+1 to select this option.

- **Elevation Plane: East-West (Z Plane: X-Axis)**

  Defines the work surface as the XZ plane. You also can press CTRL+2 to select this option.

- **Elevation Plane: North-South (Z Plane: Y-Axis)**

  Defines the work surface as the YZ plane. You also can press CTRL+3 to select this option.

- **Plane by Turn/Branch**

  Defines the work surface as the plane defined by an existing turn or branch. You select the turn or branch to set the plane. You also can press CTRL+4 to select this option.

- **Plane by Three Points**

  Defines the work surface using three points that you define. You also can press CTRL+5 to select this option.

- **No Plane**

  Clears any work surfaces. The software does not project points that you place to any plane. You also can press CTRL+6 to select this option.

Run

Defines the name of the duct run associated with the turn.

Part

Defines the part of the turn feature. The part that you select determines the other controls that display on the ribbon.

Lock

Turns on or off locking for the angle. If the angle is locked, then you cannot change the value. There are **Lock** buttons for **Angle2** and **Angle3**, but not for **Angle1**.

Angle1

Defines the angle of the selected turn feature.

Angle2 / Angle3

Defines the angle of the turn or branch feature located at the end of associated leg.

Miters

Defines the number of miters for the turn feature.

Offset

Defines the distance for offset that the software uses during feature placement. The reference is centerline, width, or depth). The route plane does not have to be active to locate the offset from the plane point.

Edit End Feature Ribbon

Reviews and modifies end features or components.

Properties

Opens a dialog box with properties for the selected feature. Allows you to review the properties of the selected feature and change the value assigned to a property.

Move From

Defines the origin of the move vector. If you do not define a starting point, the current

location of the end feature is assumed to be the starting point.

Move To

Defines the termination point of the move vector.

NOTE When you move or modify a route object in HVAC, Electrical, or Piping, Smart 3D treats any unfinished ends as free end features. An unfinished end is an end with mating parts or a logical data connection with one logical port. You can reconnect using these free end features. This behavior allows you to reuse existing mating parts and connections and reduces wait times.

Plane

- **Plan Plane**

  Defines the work surface as the XY plane at the depth of the active end. You also can press CTRL+1 to select this option.

- **Elevation Plane: East-West (Z Plane: X-Axis)**

  Defines the work surface as the XZ plane. You also can press CTRL+2 to select this option.

- **Elevation Plane: North-South (Z Plane: Y-Axis)**

  Defines the work surface as the YZ plane. You also can press CTRL+3 to select this option.

- **Plane by Turn/Branch**

  Defines the work surface as the plane defined by an existing turn or branch. You select the turn or branch to set the plane. You also can press CTRL+4 to select this option.

- **Plane by Three Points**

  Defines the work surface using three points that you define. You also can press CTRL+5 to select this option.

- **No Plane**

  Clears any work surfaces. The software does not project points that you place to any plane. You also can press CTRL+6 to select this option.

Run

Defines the name of the duct run associated with the branch.

Part

Defines the part assigned to the end feature.

Lock

Turns on or off locking for the angle. If the angle is locked, the angle at the other end of the leg is fixed at the value in the **Angle** field.

Leg Angle

Defines the angle of the leg end feature.

Rotate

Allows you to rotate the end feature.

Rotation Angle

Defines the rotation angle for the end feature.

Length Lock

Locks or unlocks the **Length** box.

Length

Defines the length for the end feature. You can enter any value needed, provided it does not conflict with the defined specifications. If the **Length Lock** is unlocked, this box displays the dynamic readout of the current end feature length.

Offset

Defines the distance for offset that the software uses during feature placement. The reference is centerline, width, or depth). The route plane does not have to be active to locate the offset from the plane point.

What do you want to do?

Create a new duct run in free space

1. Click **Route Duct** on the vertical toolbar.

2. Select the starting point for the new duct run in the graphic view. If the point that you define as the starting point is not an end feature of an existing duct, then the software automatically displays the **New Duct Run** dialog box to record properties.

3. On the **New Duct Run** dialog box, select a duct specification and assign the appropriate properties for the duct run that you are establishing.

4. Click **Plane** on the ribbon to define the working plane for the routed duct.

5. Select subsequent points in the graphic view to define the route of your new duct run.

6. Select the ending point of the new duct run.

Route a duct from a transition end

1. Select the end of the duct transition feature from which you want to continue routing.

2. Click **Route Duct** on the vertical toolbar.

3. Change the cross section of the current, or computed, duct, if needed.

    When you change a cross section, the software automatically changes the adjacent transition to accommodate the transition feature.

4. Change the routing direction, if needed.

    *When you change routing direction, the software automatically inserts or changes the turn feature or transition feature. Additional information appears later in the **Notes** section.*

5. Place the end point for the duct run.

Route a duct from an existing end feature

1. Select the end of the required duct in the model.

2. Click **Route Duct** .

3. If necessary, change the cross section of the current duct using the options on the ribbon.

    When you change a cross section, the software automatically inserts a transition feature.

4. Change the routing direction, if needed.

    *When you change routing direction, the software automatically inserts or changes the turn feature. Additional information appears later in the **Notes** section.*

5. Click in the graphic view to place the end point.

6. Continue routing or right-click to exit the command.

Assign this duct run to another existing duct run

1. From the **Run** option, select **More.**

    *The software displays the **Select Duct Run** dialog box. See* Select Duct Run Dialog Box *(on page 116).*

2. Select a duct run from the list, and then click **OK**.

3. Click in the graphic view to place the end point.

4. Continue routing or right-click to exit the command.

Route a new duct run from the end feature

1. From the **Run** option, select **<New Duct Run>.**

   *The software displays the **New Duct Run** dialog box. See* Duct Run Properties Dialog Box *(on page 104).*

2. Specify the required details, and then click **OK**.

3. Click in the graphic view to place the end point.

4. Continue routing or right-click to exit the command.

Route a new duct from a nozzle or end

1. Click **Route Duct** on the vertical toolbar.

2. Select an existing nozzle or component end from which to begin routing the duct run. When you select a nozzle or component end, the software sets the cross section of the duct to match the cross section and orientation of the nozzle or component.

3. If you start routing from a nozzle, then the **Create New Run** dialog box displays. If necessary, change the settings for the new duct segment on the ribbon.

4. Place the end point for the duct run.

Route a duct into a component or nozzle

1. Click **Route Duct** on the vertical toolbar.

2. Begin the new duct run.

3. Continue the duct run and connect the run into the component or nozzle end. The centerline must be collinear with the existing component end or nozzle for the software to connect to the existing duct. To determine if the centerline is collinear, use relationship indicators or rotate the view.

4. Change the cross section for the duct, if needed.

Route a duct into the end of an existing duct

1. Click **Route Duct** on the vertical toolbar.

2. Begin the new duct run.

3. Continue the duct run and connect the run into the end of an existing duct. If the two ducts have differing cross sections, the software inserts a transition.

 NOTE You can edit the flow direction of the duct run by clicking the flow direction indicator on the duct run and then selecting the new direction. For more information on setting the flow direction, see *Change the flow direction of a duct run* (on page 35).

Route a duct into an existing duct to create a branch

1. Click **Route Duct** on the vertical toolbar.

2. Click a starting location for the new duct run.

3. Select a point on the existing duct run that serves as the intersection between the new and existing runs and as the end point of the new run.

Create a branch from an existing duct

1. Click **Route Duct** on the vertical toolbar.

2. Click the location on the existing duct straight feature from which to start routing. The location that you select can be on the duct surface for a square cross section or on the centerline of the duct for a round cross section.

3. Change the cross section of the current duct, if needed.

4. Change the routing direction, if needed. When you change routing direction, the software automatically changes the branch surface.

5. Select a point on another run that serves as the intersection between the new and existing runs and as the end point of the new run.

Delete a feature

1. Click **Select**.

2. In the **Locate Filter** box, select **Duct Features**.

3. Select the feature to delete.

4. Click **Delete**.

    The software deletes the associated duct parts and connections. However, if you delete a turn feature, the software extends connected straight features to the turn point.

NOTE For more information on how the software performs the delete operation, refer *Appendix - Deleting at Boundary Connections* (see "*Appendix: Deleting at Boundary Connections*" on page 88).

Modify a feature

1. Click **Select** and select the feature.

2. Click **Properties** on the horizontal ribbon.

3. Change the properties to meet your needs.

4. If you need to reposition the feature, use **Move** on the main ribbon.

NOTE For more information on how the software performs the move operation, refer *Appendix: Moving at Boundary Connections* (on page 83).

Modify a straight feature

1. Click **Select** .

2. Select **Duct Features** in the **Locate Filter** list.

3. Identify the straight feature to change. You can select the feature in a graphic view or in the **Workspace Explorer**.

4. Using the options on the ribbon, change the feature to meet your needs.

5. If you need to reposition the feature, use **Move** on the main ribbon.

 NOTE For more information on how the software performs the move operation, refer *Appendix: Moving at Boundary Connections* (on page 83).

Modify a turn feature

1. Click **Select** .

2. Select **Duct Features** in the **Locate Filter** list.

3. Identify the turn feature to change. You can select the feature in a graphic view or in the **Workspace Explorer**.

4. Using the options on the ribbon, change the feature to meet your needs.

5. If you need to reposition the feature, use **Move** on the main ribbon.

 NOTE For more information on how the software performs the move operation, refer *Appendix: Moving at Boundary Connections* (on page 83).

Modify an end feature

1. Click **Select** .

2. Select **Duct Features** in the **Locate Filter** list.

3. Identify the end feature to change in either the graphic view or in the **Workspace Explorer**.

4. Using the options on the ribbon, change the feature to meet your needs.

5. If you need to reposition the feature, use **Move From** and **Move To** on the horizontal ribbon.

Modify a branch feature

1. Click **Select** .

2. Select **Duct Features** in the **Locate Filter** list.

3. Identify the branch feature to change. You can select the feature in a graphic view or in the **Workspace Explorer**.

4. Using the options on the ribbon, change the feature to meet your needs.

5. If you need to reposition the feature, use **Move** ✛ on the main ribbon.

▤ NOTE For more information on how the software performs the move operation at boundary connections, refer *Appendix: Moving at Boundary Connections* (on page 83).

Modify a set of features

1. Click **Select** ⬉ on the vertical toolbar.

2. In the **Locate Filter**, select **Duct Features**.

3. Select a feature on the ducting section to move.

4. Right-click the feature, and select an option under **Get Features**. For more information, see *Route Selection Commands* (on page 41).

5. Click **Move** ✛ on the main ribbon.

   ♦ TIP If you move the duct run end within ¼ inch (6.35 mm) of another duct run end, the software automatically connects the two ends.

6. Select a move-from point.

7. Identify the move-to point, and click the graphic view to confirm the new location.

   The software moves the duct run to the new location.

▤ NOTE For more information on how the software performs the move operation, see *Appendix: Moving at Boundary Connections* (on page 83).

Connect a Set of Duct Features

1. Click **Select** ⬉ on the vertical toolbar.

2. In the **Locate Filter**, select **Duct Features**.

3. Select a feature in the ducting section to modify.

4. Right-click the feature, and select an option under **Get Features**. For more information, see *Route Selection Commands* (on page 41).

5. Click **Move** ✛ on the main ribbon.

6. Click an end feature in the selection.

7. To connect the selection to another duct run inline, click an open end feature.

   -OR-

   To connect the selection to another duct run at a branch point, click a straight feature.

▤ NOTE The software will lengthen or shorten the duct as needed to make the connection. For more information, see *Connecting duct runs using Move* (on page 83).

Move a branch along the header

1. Click **Select** ⬉.

2. In the **Locate Filter**, select **Duct Features.**

3. Identify the branch to move, and select the straight feature of the branch.
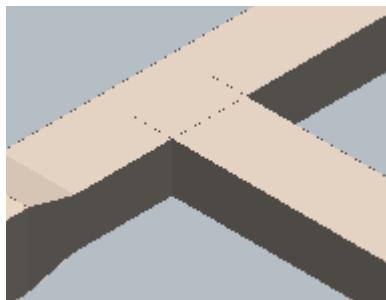
4. Click **Move** ✛ on the main ribbon.

5. Click to select the move-from location.

6. Click to select a move-to location.
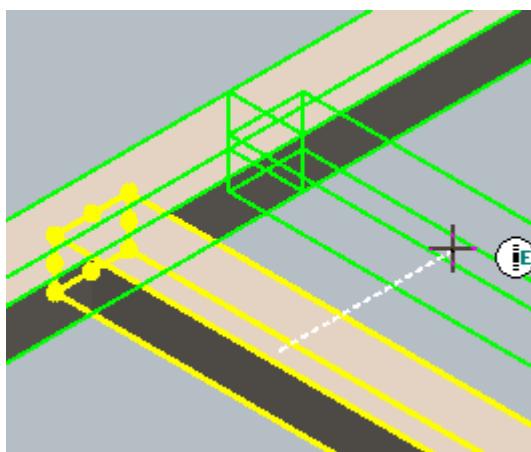
The software slides the branch without disconnecting it from the header.
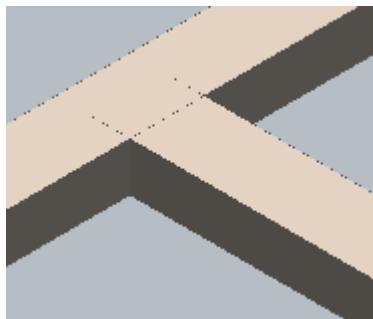
Choose a working plane

1. On the **Route Duct** toolbar, click **Working Plane** ✕.

2. Select the working surface for the duct run.

   ♥ TIP Available options for the working plane include:

   ▪ ◇ **Plan Plane**

Defines the work surface as the XY plane at the depth of the active end. You also can press CTRL+1 to select this option.

- ▪ **Elevation Plane: East-West (** **Z Plane: X-Axis)**

    Defines the work surface as the XZ plane. You also can press CTRL+2 to select this option.

- ▪ **Elevation Plane: North-South (** **Z Plane: Y-Axis)**

    Defines the work surface as the YZ plane. You also can press CTRL+3 to select this option.

- ▪ **Plane by Turn/Branch**

    Defines the work surface as the plane defined by an existing turn or branch. You select the turn or branch to set the plane. You also can press CTRL+4 to select this option.

- ▪ **Plane by Three Points**

    Defines the work surface using three points that you define. You also can press CTRL+5 to select this option.

- ▪ **No Plane**

    Clears any work surfaces. The software does not project points that you place to any plane. You also can press CTRL+6 to select this option.

Edit duct run properties

1. Select a run, and then click **Properties** .

2. On the **Properties** dialog box, click the **General** tab.

3. Review the properties that have been assigned to the duct run, including **Name**, **Specification**, **Material**, and **Thickness**.

 NOTE You can edit the flow direction of the duct run on the **Properties** dialog box, or by clicking the flow direction indicator on the duct run and then selecting the new direction. For more information, see *Change the flow direction of a duct run* (on page 35).

 TIP You can also edit the cross-section properties on the **Edit Duct Run** ribbon. For more information, see *Route Duct* (on page 20).

Change the flow direction of a duct run

1. Click **Select** on the vertical toolbar.

2. Select the duct run for which you want to change the flow direction.

    The software displays the flow direction indicators. In the following example, a duct run is going downstream:

    The flow directional indicators are listed below:

     Bi-directional

(K) Upstream

(Y) Downstream

(N) No flow

(?) Undefined

3. Click one of the flow direction indicators.

   *The software displays a **FLOW** submenu containing each flow direction indicator.*

   FLOW
   (Y)(K)(Y)(N)(?)

4. Select the new flow direction and then close the submenu.

NOTE You also can click **Properties** on the ribbon to edit the flow direction property of a run.

Edit cross section properties

1. Click **Properties** on the horizontal ribbon while routing a duct run.

2. On the **Duct Properties** dialog box, click the **Cross Section** tab.

3. Select the shape of duct that you need by using the **Cross Section** box.

4. Type appropriate dimensions for the selected cross section in the **Dimensions** boxes. Be aware that the software does *not* recalculate dimensions of existing duct automatically.

5. If needed, switch the local axis of the duct associated with the width axis of the offset cross section by clicking the **Orientation** button. The **Orientation** icon changes to indicate if the current value is set parallel or perpendicular to the width dimension of the U axis. By default the width is associated with the U axis.

6. Type the number of degrees to change the angle of the selected cross section in the **Angle** box.

Edit multiple cross section dimensions

1. Select the duct features to change by holding down the SHIFT key while selecting all the duct features along the run.

2. Click **Properties** on the horizontal ribbon.

3. On the **Duct Feature Properties** dialog box, click the **Cross Section** tab.

4. Change the dimensions for the selected features as needed. Be aware that the software does *not* automatically recalculate dimensions of existing duct.

5. If needed, switch the local axis of the duct associated with the width axis of the offset cross section by changing the orientation angle. By default the width is associated with the U-axis.

6. Type the number of degrees to change the angle of the selected cross section in the **Orientation Angle** box.

New Duct Run Properties Dialog Box

Creates a new duct run, extends an existing run, or routes to or from nozzles or end features. If you route to or from a straight feature, the software creates a branch, including all matching parts and fittings, and defines the working plane based on the plane of the branch. If you route to or from an end feature, the software extends the previous run and sets the working plane.

See Also

General Tab (New Duct Run Properties Dialog Box) (on page 37)
Cross Section Tab (on page 99)

General Tab (New Duct Run Properties Dialog Box)

Category

Specifies the general group of properties to display.

Property

Identifies various properties that you must define when you start to route a new duct run.

Value

Specifies the value for the property.

System

Displays or defines the system for the duct run. The last system that you selected is the default. Click **More** to display all defined systems. You can create a new system in the Systems and Specifications task.

Name

Displays or defines the name of the duct run that you are creating. The name is based on the **Name Rule** selection. If you want to type a new name for the run, in the **Name Rule** box, select **User Defined**, and then type a name for the run in the **Name** box.

Name Rule

Specify the naming rule that you want to use to name this run. You can select one of the listed rules or select **User Defined** to specify the run name yourself in the **Name** box.

Specification

Displays or defines the specification for the duct run. Specifications are assigned to systems in the Systems and Specifications task. Only those specifications that are allowed in the system that you selected appear. You define specifications in the reference data.

See the *HVAC Reference Data Guide* for more information on defining specifications.

Max. Recommended Velocity

Defines the maximum recommended velocity for the duct run.

Max. Recommended Pressure Loss

Defines the maximum recommended pressure loss for the duct run.

Material

Defines the material for the duct run.

Thickness

Defines the thickness of the duct run material.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog. For more information, see *Select Insulation Material Dialog Box* (on page 38).

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Flow Direction

Select the flow direction for the duct run. The flow directional indicators are as listed below:

Bi-directional

Upstream

Downstream

No flow

Undefined

Select Insulation Material Dialog Box

Specifies the insulation materials for a selected object. By browsing through the part hierarchy, you can find and select an insulation material in the Catalog database.

Save

This option is unavailable.

Cut

This option is unavailable.

Copy

This option is unavailable.

Paste

This option is unavailable.

✕ Delete

This option is unavailable.

↶ Undo

This option is unavailable.

⊒₊ꞓ Insert Row

This option is unavailable.

⬆ Move Up

This option is unavailable.

⬇ Move Down

This option is unavailable.

⊞ Properties

Displays the properties of the selected object. Because you cannot modify any properties until the object is placed, all properties on the **Properties** dialog box are read-only.

⊟ Preview

Displays a bitmap symbol of the selected object. The image file must be assigned to the object in the catalog reference data.

▽ Filter

This option is unavailable.

⅋↓ Sort

This option is unavailable.

⊞ Customize Current View

This option is unavailable.

☰ List View

Sets the dialog box to display insulation thickness values in a list view.

⊞ Grid View

Sets the dialog box to display insulation thickness values in a spreadsheet-style grid view.

⇦ Back

Returns you to the previously selected insulation material folder. Use this command to navigate through the hierarchy to the specific insulation material you need.

⇨ Forward

Sends you to the last selected insulation material folder that you moved away from by using the **Back** button. Use this command to navigate through the hierarchy to the specific insulation material you need.

⬆ Up One Level

Brings up the next highest level of the hierarchy. Use this command to navigate through the

hierarchy to the specific material you need.

Check Data

This option is unavailable.

CheckData Ignored Inconsistencies

This option is unavailable.

Smart 3D Help

This option is unavailable.

Address

Sets the current location within the hierarchy of available insulation materials. The dropdown box lists the folders you have visited.

Route Selection Commands

Route selection commands allow you to select part of a route network to modify. Use the **Get Features** commands to select a section of a route network using one or more features on that network. The **Get Connected Supports** command allows you to select connected supports of a feature. To select only the runs in a route network, select one or more associated features to the runs and use the **Get Runs** command.

These commands simplify the selection of a specific section of the piping network. For example, if you want to modify a pipe leg along with its supports, select the pipe leg using **On Same Leg**, and add the hangers supporting the pipe leg using **Get Connected Supports**.

To access the commands, right-click a duct feature.

★ IMPORTANT

- You must select **Duct Features** option in the **Locate Filter**.

- **Get Features** commands do not support combined features that belong to different tasks. For example, you cannot combine Piping and HVAC features, or Electrical and HVAC features.

Get Features Commands

Contains a group of commands that allow you to select a section of the targeted route network. The **Get Features** commands apply to features that are in the select set and are defined in the Workspace. You can select one or more features on the network. You can also combine the following commands to extend the targeted network as necessary.

On Same Run

Selects all features that belong to a same run even if the run is discontinuous.
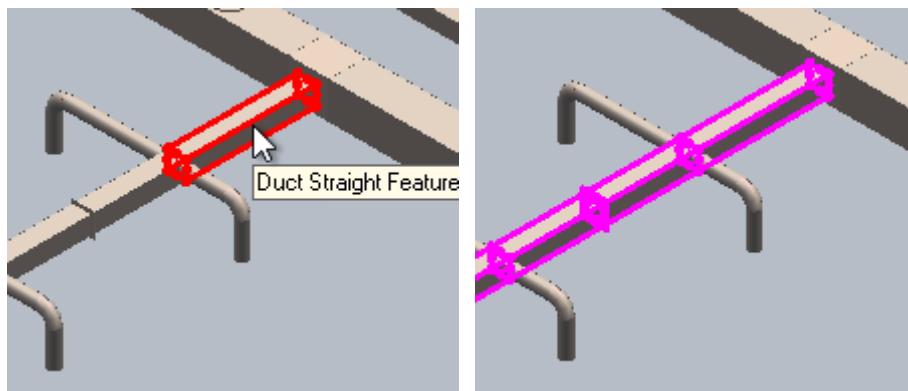
On Same Leg

Selects all features that belong to a same leg. The software also includes the along leg feature if the selected leg is a branch.

📄 NOTE A leg is a group of route features routed in the same direction.
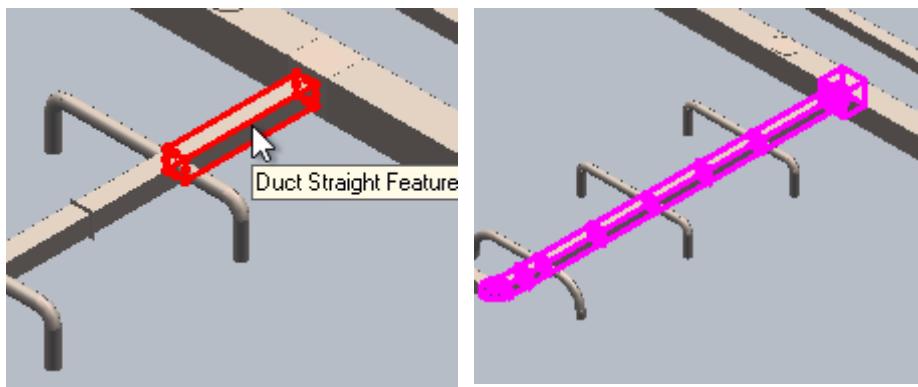
On All Connected Branches

Selects all features associated to the connected branches. You must select an along-leg feature that has a branch connected to it. For example, select an along-leg feature that has a branch connected to it. Right-click and select **On All Connected Branches.** The software selects the associated features connected to the branch run until it branches into a header run, or until a free end is traversed.
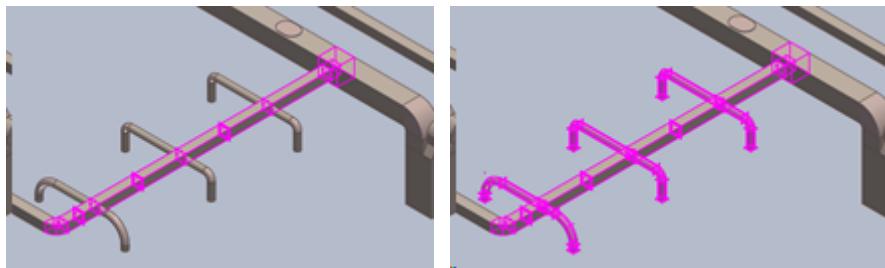
For Connected Fittings

Adds the immediate connected fittings to the selection. You must select a branch component.

TIP You can select a leg using **On Same Leg,** and then use **For Connected Fittings** to add all the adjacent branch fittings on that leg to the selection.

Get Connected Supports

Selects all supports connected to the selected feature. This command does not support duct banks. However, you can use this command on conduit in a duct bank.

Get Runs

Selects only the runs associated with the selected feature or features. This command does not support duct banks. However, you can use this command on conduit in a duct bank.
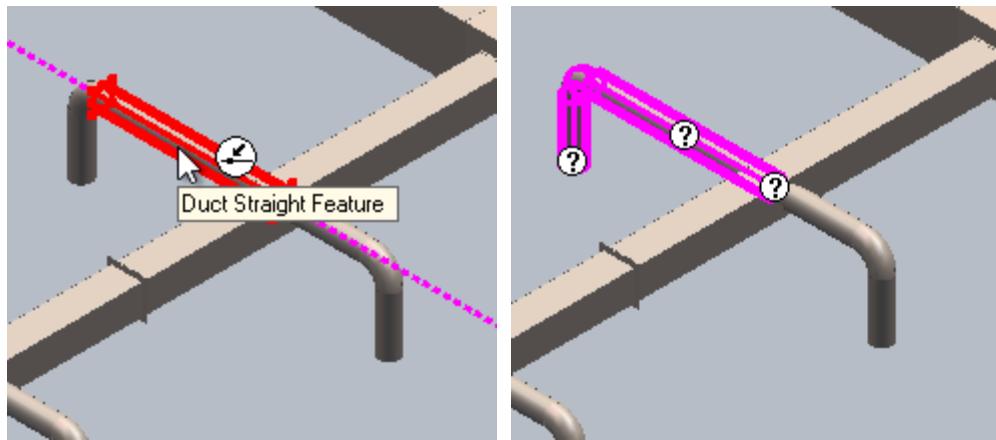
Get Continuously Connected

Selects the feature and all features that are continuously connected to that feature.
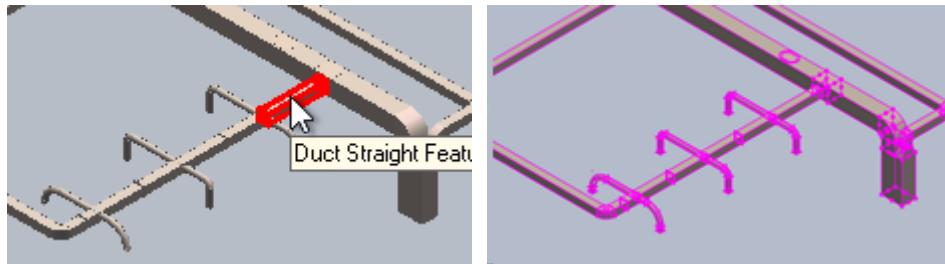
S ECTION 4
Insert Split

✚ Cuts a duct into two or more segments and inserts a split feature to connect the ends of the split. Split features include flanges, sleeves, or welds.

You can start the **Insert Split** command without finishing the **Route Duct** command. That is, you can split parts and then continue routing the duct. If you end the **Route Duct** command after placing the split and do not place other features, so that the split feature and end feature are in the same location, the software automatically deletes the split feature.

For some split types, you need to use **Depth Slope** to orient the split correctly. You can insert a split between non-straight features, such as turns, and also between non-straight and straight features.

📄**NOTE** Split and Division components are not the same and are used for different purposes. The Split component enables you to split a straight feature with either one part (weld) or a pair of parts (flanges). The Division component lets you reduce the main trunk of a duct system by adding a division part with two or three ports. You can only insert Division components at an End feature.

The example figure below shows a trunk duct system containing both a Division component and a Split component. The Split component in the example is a rectangular weld which splits the main trunk duct. A Division component is in place on the main trunk and enables you to branch out with takeoff fittings such as elbows or transitions.
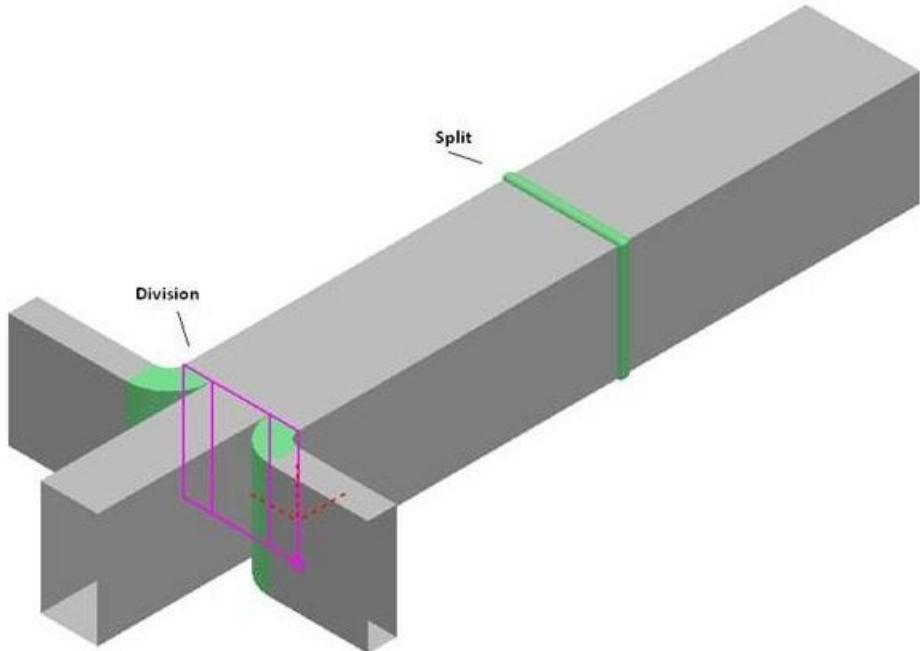
Insert Split Ribbon

Defines and modifies options for a split that divides a duct straight feature into two, or more, segments, or inserts flanges on non-straight features like turns and transitions.

Properties

Activates the **Properties** dialog box for the selected split. The default value for all properties is the last value that you used, except for those values from the end feature parameters. For more information, see *Duct Split Feature Properties Dialog Box* (on page 48).

Select Feature

Selects the duct feature in which you want to insert a split.

Part

Provides a list of previously selected parts; or click **More** to access more parts.

Position

Positions the location to insert the split by dragging the part to that location.

Finish

Ends the split process.

Run

Defines the name of the duct run to which the split belongs. This box displays the duct runs that belong to the selected feature. Click **More** to browse for a duct run that is not in the list. For more information, see *Select Duct Run Dialog Box* (on page 116). While inserting a split, you cannot create a new duct run.

Name

Provides a name for the new feature.

Split Mode

Defines the type of split to modify: **Single Split** or **Multi Split**. Use Single Split to break the duct into two segments. Use Multi Split to break the duct into multiple segments.

Reference

Defines the **Start** and **End** of the new feature.

Duct Length

Defines the length of the duct to split.

Depth Slope

Defines the slope angle to the depth axis. The **Depth Slope** box displays only if you select a split type that supports slope. Values range from -89 to 89.

Edit Split Feature Ribbon

Reviews and modifies end features or components.

Properties

Opens a dialog box with properties for the selected feature. Allows you to review the properties of the selected feature and change the value assigned to a property.

Move From

Defines the origin of the move vector. If you do not define a starting point, the current location of the split is assumed to be the starting point.

Move To

Defines the termination point of the move vector.

Run

Displays a list containing all existing runs in the same system as the run that you last placed. If you select an existing duct run from the list, the software activates that run. The **New Duct Run** option opens the **New Duct Run** dialog box. The **More** option opens the **Select Duct Run** dialog box.

Part

Defines the part assigned to the run and the end feature. Flanges on the transition or on the turn can also be edited.

Depth slope

States the slope angle to the depth axis. **Depth Slope** is displayed only if you select a reference data type that supports slope. Values range from -89 to 89.

What do you want to do?

- *Insert a single split* (on page 46)
- *Insert multiple splits* (on page 47)
- *Modify a split feature* (on page 47)
- *Edit split properties* (on page 47)

Insert a single split

1. Click **Insert Split** on the vertical toolbar.
2. Set **Split Mode** to **Single Split**.
3. Select the duct feature to split.
4. Select the **Part** that you want to use for connecting the two segments.
5. Click the duct run to precisely locate the point to insert the split, or click **Position** and drag and release the part at its location.
6. Click **Properties** to further configure the split. You can complete this step at any time during this procedure.
7. Click **Finish** when you are done.

Insert multiple splits

1. Click **Insert Split** ![icon] on the vertical toolbar.

2. Select the **Run** to which you want the segments applied.

3. Set **Split Mode** to **Multi Split**.

4. Select the duct feature to split.

5. Select the **Part** that you want to use for connecting the new segments.

6. Type the **Duct Length** for the new segments.

7. Click **Properties** ![icon], to further configure the splits. You can complete this step at any time during this procedure.

8. Click **Finish** when you are done.

Modify a split feature

1. Click **Select** ![icon].

2. Select **Duct Features** in the **Locate Filter** list.

3. Identify the split feature to change. Select the feature in a graphic view or in the **Workspace Explorer**.

4. Using the options on the ribbon, change the feature to meet your needs.

5. If you need to reposition the feature, use **Move From** ![icon] and **Move To** ![icon] on the horizontal ribbon.

Edit split properties

1. While inserting a split or flange on a straight feature in the model, click **Properties** ![icon] on the **Insert Split** horizontal ribbon.

2. On the **General** tab of the **Duct Split Properties** dialog box, select the parent duct run to which the split will belong in the **Duct Run** box.

3. Set the type of split in the **Part** box.

4. For a rectangular flat flange, use the **Width Slope** and **Depth Slope** boxes to set the orientation of the split.

Duct Split Feature Properties Dialog Box

Reviews or changes properties for the split feature in the duct run. To open this dialog box, select the feature created by the split—not the duct run.

See Also

General Tab (Duct Split Feature Properties Dialog Box) (on page 48)
Cross Section Tab (on page 99)
Relationship Tab (on page 104)
Configuration Tab (on page 98)

General Tab (Duct Split Feature Properties Dialog Box)

Sets the general properties of the split.

Duct Run

Defines the name of the duct run.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Part

Specifies the part used to split the duct.

Depth Slope

States the slope angle to the depth axis. **Depth Slope** is displayed only if you select a reference data type that supports slope. Values range from -89 to 89.

Insert Transition

Adjusts the duct to accommodate all possible combinations of change in shape. You can create a transition feature only on an existing end feature or HVAC port. By inserting a transition feature, you are changing a cross section in the duct routing. The software allows you to manually place and modify a transition.

Insert Transition Ribbon

Creates duct transitions for possible combinations of change to shape, size, and orientation.

NOTE The contents of the ribbon depend on the feature that you select.

Properties

Opens the **Transition Settings** dialog box with properties for the inserted transition feature. For more information, see *Duct Transition Feature Properties Dialog Box* (on page 54).

Start Transition

Click to identify the start point of the transition. If you do not define a starting point, the software uses the current location of the object as the starting point.

Offset Transition

Click to identify the offset location for the transition.

Finish

Ends the placement of the transition feature. Click this button after you are satisfied with the editing that you have completed.

Plane

- **Plan Plane**

  Defines the work surface as the XY plane at the depth of the active end. You also can press CTRL+1 to select this option.

- **Elevation Plane: East-West (Z Plane: X-Axis)**

  Defines the work surface as the XZ plane. You also can press CTRL+2 to select this option.

- **Elevation Plane: North-South (Z Plane: Y-Axis)**

  Defines the work surface as the YZ plane. You also can press CTRL+3 to select this option.

- **Plane by Turn/Branch**

  Defines the work surface as the plane defined by an existing turn or branch. You select the turn or branch to set the plane. You also can press CTRL+4 to select this option.

- **Plane by Three Points**

Defines the work surface using three points that you define. You also can press CTRL+5 to select this option.

- **No Plane**

  Clears any work surfaces. The software does not project points that you place to any plane. You also can press CTRL+6 to select this option.

- **Width Plane**

  Defines the work surface along the width of the duct. This option is available when **Shape** is defined as **Rectangle** or **Flat Oval**, and **Type** is defined as **Turn** or **Miter Turn**.

- **Depth Plane**

  Defines the work surface along the depth of the duct. This option is available when **Shape** is defined as **Rectangle** or **Flat Oval**, and **Type** is defined as **Turn** or **Miter Turn**.

Run

Defines the name of the duct run associated with the transition. If you select **New Duct Run**, the **New Duct Run** dialog box opens. The **New/Continue Run** option automatically activates the duct run of the selected feature.

Type

Defines the type of transition feature. Options include **Straight Parallel**, **Straight Slanted**, **Turn,** and **Miter Turn**.

Shape

Defines the shape of the duct. You can change size and orientation, as needed. Options include **Rectangle**, **Round**, and **Flat Oval**.

Width

Defines the width of the new rectangular or flat oval cross sections. Values stored in the reference data determine the list of options. Also, you can enter an amount for the width.

Depth

Defines the depth of the transition feature. The **Depth** box displays for rectangular and flat oval features. Values stored in the reference data determine the list of options. Also, you can enter an amount for the depth but the amount must be less than or equal to the width.

Radius

Defines the corner radius of the feature. The **Radius** box displays only for rectangular transitions. Values stored in the reference data determine the list of options. Also, you can enter an amount for the radius.

Diameter

Defines the diameter for a circular transition feature.

Orientation

Defines the orientation of the duct run by specifying the angle between the local axis of the duct run and the width axis. A value of 0 results in a duct run with the width horizontal and the depth vertical. A value of 90 degrees results in the width vertical and the depth horizontal. The value for an angle ranges from 0 to 360 degrees.

Align

Defines the transition alignment. Options include **Align Centerline**, **Align Top Left**, **Align Top Right**, **Align Bottom Right**, **Align Bottom Left**, **Align Top Center**, **Align Right Center**, **Align Bottom Center**, **Align Left Center**, and **Not Aligned**.

Length

Defines the length of the transition.

Throat Radius

Defines the radius of the transition throat. The **Throat Radius** box displays only if the **Type** option is set to **Turn**.

Lock

Turns on or off the lock for the angle constraint. The icons show the status of the lock (on or off).

Angle

Defines the angle of the turn transition and is available for turn and miter turn transitions.

Miters

Defines the number of miters for the miter turn transition feature. The number of miters returns to the default value whenever you modify the angle, either directly or indirectly. The value can range from 1 to 99.

Edit Transition Feature Ribbon

Reviews and modifies transition features.

Properties

Opens a dialog box with properties for the selected feature. Allows you to review the properties of the selected feature and change the value assigned to a property.

Move From

Defines the origin of the move vector. If you do not define a starting point, the current location of the transition is assumed to be the starting point.

Move To

Defines the termination point of the move vector.

End

Defines which end of the transition you are modifying.

Plane

- **Plan Plane**

  Defines the work surface as the XY plane at the depth of the active end. You also can press CTRL+1 to select this option.

- **Elevation Plane: East-West** (**Z Plane: X-Axis**)

  Defines the work surface as the XZ plane. You also can press CTRL+2 to select this option.

- **Elevation Plane: North-South (Z Plane: Y-Axis)**

  Defines the work surface as the YZ plane. You also can press CTRL+3 to select this option.

- **Plane by Turn/Branch**

  Defines the work surface as the plane defined by an existing turn or branch. You select the turn or branch to set the plane. You also can press CTRL+4 to select this option.

- **Plane by Three Points**

  Defines the work surface using three points that you define. You also can press CTRL+5 to select this option.

- **No Plane**

  Clears any work surfaces. The software does not project points that you place to any plane. You also can press CTRL+6 to select this option.

- **Width Plane**

  Defines the work surface along the width of the duct. This option is available when **Shape** is defined as **Rectangle** or **Flat Oval**, and **Type** is defined as **Turn** or **Miter Turn**.

- **Depth Plane**

  Defines the work surface along the depth of the duct. This option is available when **Shape** is defined as **Rectangle** or **Flat Oval**, and **Type** is defined as **Turn** or **Miter Turn**.

Type

Defines the transition type for the active end.

Shape

Defines the shape of the transition end. The shape you select determines the other controls that display on the ribbon.

Rectangle

Width

Defines the width of the feature.

Depth

Defines the depth of the feature.

Radius

Defines the corner radius of a rectangular duct.

Round

Diameter

Defines the diameter of the feature.

Flat Oval

Width

Defines the width of the feature.

Depth

Defines the depth of the feature.

Orientation

Defines the orientation of the transition end. A value of 0 results in a transition end with the width horizontal and the depth vertical. A value of 90 degrees results in the width vertical and the depth horizontal. The value for an angles ranges from 0 to 360 degrees.

⊠ **Align**

Defines the transition alignment. Options include **Align Centerline**, **Align Top Left**, **Align Top Right**, **Align Bottom Right**, **Align Bottom Left**, **Align Top Center**, **Align Right Center**, **Align Bottom Center**, **Align Left Center**, and **Not Aligned**.

Length

Defines the length of the transition end.

What do you want to do?

- *Insert a transition feature* (on page 53)
- *Modify a transition feature* (on page 53)
- *Edit transition properties* (on page 54)

Insert a transition feature

1. Click **Insert Transition** ▷ on the vertical toolbar.
2. Set the transition start point by selecting an end feature or nozzle connection port.
3. Set the transition offset point to determine the position of the offset cross section of the transition feature.
4. If necessary, change the available options for the transition.

Modify a transition feature

1. Click **Select** ↳.
2. Select **Duct Features** in the **Locate Filter** list.
3. Identify the transition feature to change. You can select the feature in a graphic view or in the **Workspace Explorer**.
4. Using the options on the ribbon, change the feature to meet your needs.
5. If you need to reposition the feature, use **Move From** ↗ and **Move To** ↗ on the horizontal ribbon.

Edit transition properties

1. After selecting an end feature or nozzle to insert the transition feature, click **Properties** 📑 on the **Insert Transition** ribbon.

2. On the **General** tab of the **Transition Properties** dialog box, choose the parent duct run for your transition using the **Duct Run** box. Choosing **More** in this box allows you to choose from all duct runs associated with the active system.

3. Set the values for **Type**, **Length**, **Throat Radius**, **Angle**, and **Tightness** in the appropriate boxes, if necessary.

4. On the **Cross Section** tab of the **Transition Properties** dialog box, complete any necessary adjustments to the shape and dimensions of the transition for the needed flow rate.

Duct Transition Feature Properties Dialog Box

Allows you to review or change details that relate to general, configuration, cross section, and relationship properties for the transition feature in the duct run.

See Also
General Tab (Duct Transition Feature Properties Dialog Box) (on page 54)
Cross Section Tab (on page 99)
Relationship Tab (on page 104)
Configuration Tab (on page 98)

General Tab (Duct Transition Feature Properties Dialog Box)

Displays while working with the **Route Duct** command to create or modify property values or learn status information about a duct run.

Duct Run

Defines the duct run to which the transition is assigned.

Material

Defines the material from which the transition is manufactured.

Thickness

Defines the thickness of the transition material.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Type

Defines the type of transition.

Length

Defines the length of the transition.

Insert Inline Component

Places components that the software cannot place automatically during routing. When inserting components, the software automatically splits the duct and adds the necessary transitions. The **Insert In-line Component** command cannot place hoods, terminal boxes or plenums, which are enclosures or chambers that contain gas at a higher pressure than the surrounding atmosphere. You can place these components as equipment in the Furnishings and Equipment task.

Insert Inline Component Ribbon

Specifies the options for placing an In-line component in the design.

Properties

Opens the **Insert Component Settings** dialog box. You can use this dialog box to define properties of the component after you select a feature and specify a part. For more information, see *Insert Component Properties Dialog Box* (on page 59).

Select Straight or End Feature

Select the duct, duct end, component port, or nozzle for the component that you are placing.

Part

Defines the component to insert from the catalog. The list includes the last ten names of component parts that you have placed. The **More** option opens the **Select Part** dialog box for browsing the catalog for the correct part.

Enter Insertion Point

Positions the component that you are placing along the duct that you selected. You can use **Tools > PinPoint** and **Tools > Point Along** to define the precise location of the component on the duct run.

Finish

Places the component in the duct run.

Run

Defines the name of the duct run with the component that you placed. The selection list includes:

- Duct runs assigned to the parent system of the end feature or straight feature that you selected

- **More** to allow you to browse the catalog for a different duct run

- **New Duct Run** to open the **New Duct Run** dialog box

- **New/Continue Run** to use the duct run of the end feature or straight feature that you selected

Name

Defines the occurrence name of the component that you are placing. The name can have a maximum of 64 characters.

Flip

Changes the component port that is connected to the selected port.

Reference position

Defines the insertion point of the component by a particular port or by its origin.

Rotate

Rotates the component about the duct interactively around the feature axis.

Angle

Defines the angle for rotating the component about the duct.

Edit Inline Component Ribbon

Reviews and modifies in-line components.

Properties

Opens a dialog box with properties for the selected feature. Allows you to review the properties of the selected feature and change the value assigned to a property.

Move From

Defines the origin of the move vector. If you do not define a starting point, the current location of the in-line component is assumed to be the starting point.

Move To

Defines the termination point of the move vector.

Part

Defines the part assigned to the in-line component.

Name

Defines the occurrence name of the component that you are placing.

Flip

Changes the component port that is connected to the selected port. If you are modifying a tee, or other tee-type branch into a length of duct or between two other components, only the inline ports of the component are available. However, if you insert the same component at the end of a duct or at a nozzle, all component ports are available.

Rotate

Rotates the component about the duct interactively around the feature axis.

Angle

Defines the angle for rotating the component about the duct.

Select Part Dialog Box

Allows you to access the HVAC parts node and browse the Catalog for the part that you want to assign to the component. If you select a straight feature, end feature, nozzle, or component port while placing an in-line component, and then click **More** in the **Part** box on the ribbon bar. The **Select Part** dialog box opens.

What do you want to do?

- *Insert an inline component* (on page 58)
- *Modify an Inline component feature* (on page 58)
- *Edit component properties* (on page 59)
- *Modify component weight attributes* (on page 59)

Insert an inline component

1. Click **Insert In-line Component** on the vertical toolbar.
2. Select a straight feature, end feature, branch, turn, nozzle, or component port at the location to place the inline component.
3. Select a part in the **Part** box; or click **More** to browse the catalog for the part.
4. On the **Select Part** dialog box, click the part to place.
5. After you select an inline component, click **OK** on the **Select Part** dialog box.
6. Click the location to place the inline component.

   ♥ TIP When you select an end feature, the component appears automatically at the end feature point, and you can omit the following step.

7. Click **Reference Position** to select the component or origin to insert along the duct run.
8. Use the **Flip** and **Rotate** buttons to align the component precisely.
9. Check the value in the **Angle** box, and complete any needed adjustments. The **Angle** box reflects the absolute oriented value.

Modify an inline component feature

1. Click **Select** .
2. Select **Duct Features** in the **Locate Filter** list.
3. Identify the inline feature to change. You can select the feature in a graphic view or in the **Workspace Explorer**.
4. Using the options on the ribbon, change the feature to meet your needs.
5. If you need to reposition the feature, use **Move From** and **Move To** on the horizontal ribbon.

Edit component properties

1. Click **Properties** on the horizontal ribbon during the insertion of the component.

2. On the **General** tab of the **Properties** dialog box, select a parent duct run for the component in the **Duct Run** box.

3. Type the name of the component in the **Name** box.

4. On the **Placement** tab of the **Properties** dialog box, type the needed rotation angle and reference position in the appropriate boxes. If the selected component is surface-mounted, also select a value in the **Mounting Reference** and **Mounting Offset Distance** boxes.

Modify component weight attributes

1. Click **Select**, and then click on the duct part.

   -OR-

   Click **Select**, and set a filter to select the duct part.

2. Open the duct part **Properties** page.

   -OR-

   If you selected a duct feature, open its **Properties** page, click the **Relationships** tab, select **Base Part** in the **Type** box, and click **Go To**.

3. Enable **Dry WCG Origin** and **Wet WCG Origin** by clicking the **Occurrence** tab and setting the category to **Weight and CG**.

4. Select **Defined** in the **Dry WCG Origin** or **Wet WCG Origin** fields. Do not select **Compute;** you will be unable to edit the weight attributes.

5. Key in the required values for the following fields: **Dry Weight**, **Wet Weight**, **Dry CogX**, **Dry CogY**, **Dry CogZ**, **Wet CogX**, **Wet CogY**, **Wet CogZ**. You can select dry weight, wet weight, or both.

6. Click **OK** on the **Properties** page.

Insert Component Properties Dialog Box

Specifies the properties of in-line duct components.

See Also
General Tab (Insert Component Properties Dialog Box) (on page 60)

General Tab (Insert Component Properties Dialog Box)

Creates or modifies property values or displays status information about an object. The properties that display depend on the reference data defined for the object. For more information, see the *HVAC Reference Data Guide* available from the **Help > Printable Guides** command in the software.

Duct Run

Defines the run to which you assigned the feature.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Name

Displays the name assigned to the in-line component.

Part

Displays the part description assigned to the in-line component.

Number of Vanes

Defines the number of vanes used for branches during routing. To add the weight and center of gravity of the branches vanes in the branches feature calculations, assign the values for the duct material and thickness of the branches feature as the values for the vane material and thickness equals (that is, these values are equal). The range of values for **Number of Vanes** includes non-negative integers.

Vane Length

Defines the length of the specified vanes.

Insert Surface Mount Component

Places a surface-mounted component at the location and rotation that you specify. This type of component attaches to the duct wall.

Insert Surface Mount Component Ribbon

Places a component on the surface of a duct in the design.

Properties

Opens the **Insert Surface Mount Component Properties** dialog box. You can use this dialog box to define specifications of the surface-mounted component after you select a feature and specify a part. For more information, see *Insert Surface Mount Component Properties Dialog Box* (on page 63).

Select Feature

Allows you to select the straight feature or turn for the surface-mounted component that you are placing.

Component Part

Defines the surface-mounted component to insert from the catalog. The list includes the last 10 names of surface-mounted component parts that you have placed. The **More** option opens the **Select Part** dialog box for browsing the catalog for the correct part.

Enter Insertion Point

Positions the surface-mounted component that you are placing along the duct that you selected. You can use **Tools > PinPoint** and **Tools > Point Along** to define the precise location of the surface-mounted component on the duct run.

Finish

Places the surface-mounted component in the duct run.

Reference position

Defines the insertion point of the surface-mounted component by a particular port or by its definition origin. If you have not selected a component, the only available option is **Origin**.

Mount

Defines a reference point on the duct surface for defining the position of the surface-mounted component. A palette menu provides the following options: top surface, left side; top surface, center; top surface, right side; bottom surface, left side; bottom surface, center; bottom surface, right side; left surface, top side; left surface, center; left surface, bottom side; right surface, top side; right surface, center; and right surface, bottom side.

For round and flat oval cross sections, the corner (left/right/top/bottom side) references are mapped to the curved portion of the cross section shape at a point 45 degrees from the start or end of the cross section curve.

Offset

Defines the offset distance of the mount point for the surface-mounted component from the mounting reference.

Name

Defines the occurrence name of the surface-mounted component that you are placing.

Rotate

Rotates the surface-mounted component about the duct interactively around the feature axis.

Angle

Defines an angle for rotating the surface-mounted component about the duct.

Edit Surface Mount Component Ribbon

Reviews and modifies surface-mounted components.

Properties

Opens a dialog box with properties for the selected surface-mounted component feature. Allows you to review the properties of the selected feature and change the value assigned to a property.

Move from

Defines the origin of the move vector. If you do not define a starting point, the current location of the end feature is assumed to be the starting point.

Move to

Defines the termination point of the move vector.

Component part

Defines the part assigned to the surface-mounted component. The list includes the last 10 names of surface-mounted component parts that you have placed. The **More** option opens the **Select Part** dialog box for browsing the catalog for the correct part.

Mount

Defines a reference point on the duct surface for defining the position of the surface-mounted component. A palette menu provides the following options: top surface, left side; top surface, center; top surface, right side; bottom surface, left side; bottom surface, center; bottom surface, right side; left surface, top side; left surface, center; left surface, bottom side; right surface, top side; right surface, center; and right surface, bottom side.

For round and flat oval cross sections, the corner (left/right/top/bottom side) references are mapped to the curved portion of the cross section shape at a point 45 degrees from the start or end of the cross section curve.

Offset

Defines the offset distance of the mount point for the surface-mounted component from the mounting reference.

Name

Defines the occurrence name of the surface-mounted component that you are placing.

Rotate

Rotates the surface-mounted component about the duct interactively around the feature axis.

Angle

Defines the angle for rotating the component about the duct.

What do you want to do?

- *Insert a surface-mounted component* (on page 63)
- *Modify a surface-mounted component* (on page 63)

Insert a surface-mounted component

1. Click **Insert Surface Mount Component** on the vertical toolbar.
2. Select the duct on which to insert the surface-mounted component.
3. Select a surface-mounted component from the **Component part** list, or choose **More** to browse the catalog for the part that you need.
4. Set the other options on the ribbon bar to meet your needs.
5. Select the location on the duct for the surface-mounted component.

Modify a surface-mounted component

1. Click **Select**.
2. Select **Duct Features** in the **Locate Filter** list.
3. Identify the surface-mounted component to change. You can select the component in the graphic view or in the **Workspace Explorer**.
4. Using the options on the ribbon, change the component to meet your needs.
5. If you need to reposition the component, use **Move From** and **Move To** on the horizontal ribbon.

Insert Surface Mount Component Properties Dialog Box

Displays general and placement properties for the surface-mounted component in a duct run.

See Also

General Tab (Insert Surface Mount Component Properties Dialog Box) (on page 64)
Placement Tab (Insert Surface Mount Component Properties Dialog Box) (on page 64)

General Tab (Insert Surface Mount Component Properties Dialog Box)

Allows you to set options for adding a surface-mounted component into a duct run.

Duct Run

Defines the duct run into which you are inserting the surface-mounted component.

Name

Defines the name of the surface-mounted component.

Part

Defines the part number of the component part.

Placement Tab (Insert Surface Mount Component Properties Dialog Box)

Sets options for adding a surface-mounted component into a duct run.

Component Reference

Defines the origin or the port to place the surface-mounted component. By its design, a surface-mounted component has port 1, its origin, and port 2 on the positive x-axis of the symbol definition.

Mount Reference

Defines a point of reference along a feature for the offset position and other positioning calculations.

Mount Offset

Defines the offset distance between the duct run and the surface-mounted component that you are placing. The properties return to the same state for the orientation, angle, length, offset, turn type, and turn radius gadgets.

Rotation Angle

Defines the number of degrees in the angle that you want to route around the surface-mounted component. The command allows you graphically rotate the component around the feature axis.

Generate Spools

Allows you to define the spooling parameters for the ducting objects and planning blocks. In turn, these spools drive orthographic drawings and MTO reports. MTO is the material take-off report, also called a bill of materials.

Use the control point subtype **Duct Break Point** to identify spools, and then use the **Generate Spools** options to identify how you want the software to react to the control points. After spooling, you can view the spools on the **Assembly** tab in the **Workspace Explorer**.

What do you want to do?

- *Create a duct spool* (on page)
- *Delete a duct spool* (on page)
- *Edit duct spool properties* (on page)

Using Duct Spools

Duct spools are collections of specified duct parts or assembly blocks that can be used to create an orthographic drawing and to drive an MTO (material take-off report). The software creates spools, or fabrication assemblies, by breaking an HVAC system into pieces that you specify with duct break points, a new type of control point.

NOTE Only parts whose **Fabrication Requirement** is set to **By Fabricator** are included in the spool.

If the duct parts are not properly connected, separate spools will be created. The spool hierarchy relationship is created between the spool and the duct parts.

After generating the spools, the software stores them in the model database and displays the spools on the **Assembly** tab in the **Workspace Explorer**. Also, the duct or assembly block becomes the parent object of the new spools. This process allows spools to be named according to the duct or assembly block and keeps track of spools that may be out-of-date, based on the modification date of the parent object.

Naming Rules

The software uses a naming rule to give each spool a unique name. The default spool name contains a prefix based on the spool parent and a mark number. The mark number ensures that the spool name is unique and provides a sequencing of spools within a spool parent. You can also modify the naming rules to match your company needs. In addition, you can interactively change the name of a spool by selecting it, displaying the **Properties** dialog box, and typing a different name.

For more information about naming rules, see the *Smart 3D Reference Data Guide* available from the **Help > Printable Guides** command.

Where Spools Break

You place control points at connection objects using **Insert > Control Point** to break spools along the duct run. Be sure to select the **Subtype** to **Duct Break Point**. You have the option to break only at control points, break at control points and intrinsic breaks, or to ignore control points.

Spools also break because of non-connected parts and because of parts whose **Fabrication Requirement** is not **By Fabricator**.

Changing the Spooling Basis

You can base your spools on duct runs or planning blocks. If you need to change the spooling basis after spooling has begun, for best results, delete any existing spools, change the spooling basis, and then create new spools using the new spooling basis. For ducting, the spooling basis is an option on the dialog box and it is not defined in the catalog. In Model, the only option is **Ducting System**.

Specifying Oversized Spools

At creation time, the software checks the size of each spool against the maximum length, height, and width spool dimensions that you specify. These dimensions are changed on the dialog box as they are not in the catalog.

The software marks spools that exceed the maximum size as oversized so that the designer can insert additional breaks as needed. This check helps to ensure the spools that require dipping in a tank for galvanization, descaling and pickling, and so forth will actually fit in the immersion tank. Also, spools can be marked oversized that are too large to fit in fabrication equipment such as bending machines or annealing ovens, or are too large for shipping. You can check for oversized spools in the following ways:

- View the **Assembly** tab of the **Workspace Explorer**. The icon for an oversized spool contains a red *X,* .

- Click **File > Define Workspace** and view the **Assembly** tab on the **Filter Properties** dialog box. Again, the icon for an oversized spool contains a red *X,* .

- View the **Properties** dialog box for the spool. The **Spool Oversized Flag** property on the **Occurrence** tab is set to **True** if the spool is oversized.

Updating Spools

The software uses a detailed change management routine that prevents existing spools from being arbitrarily renumbered. When a duct run, duct system, or block is re-spooled, only the portion of the duct run, duct system, or block that changed is impacted by the changes to its spools. New spools are only created as needed and existing spools do not lose their numbers (even if the result is that the numbers are now out of sequence within the duct run). Existing spools are only deleted as required. This change management ensures that spools are not needlessly modified and that spool sheets are not marked as being out-of-date unless that is absolutely the case.

Change management can be turned on and off using the **Delete Existing Spools** option on *Options Tab (Duct Spool Generation Dialog Box)* (on page 67). The default option is off (False).

Deleting Spools

You can delete spools by selecting them on the **Assembly** tab of the **Workspace Explorer** and then clicking **Delete** ✗. The duct parts that were assigned to the deleted spool are reassigned to the deleted spool assembly's parent object. In addition, the software automatically deletes a spool when the last part in the spool is deleted. Parts that were assigned to the deleted spool are automatically reassigned to the deleted spool's parent object in **Workspace Explorer**. The software automatically deletes a spool when the last part in the spool is deleted.

See Also
Generate Spools (on page 65)

Duct Spool Generation Dialog Box

Allows you to specify the Ducting System and planning block that you want to spool.

OK

Processes the selected object into spools using the options that you specify.

Cancel

Exits the dialog box.

See Also
Spooling Tab (Duct Spool Generation Dialog Box) (on page 67)
Options Tab (Duct Spool Generation Dialog Box) (on page 67)
Log Tab (Duct Spool Generation Dialog Box) (on page 68)

Spooling Tab (Duct Spool Generation Dialog Box)

Lists the systems from which you can select objects for spooling.

Options Tab (Duct Spool Generation Dialog Box)

Lists the properties and values of the spool.

Spooling Basis

Lists the type of objects to be spooled. In plant mode, the only option is **Ducting System**. In marine mode, you also have the option to spool by **Block**.

Naming Rule

Specifies the naming rule for spools.

Delete Existing Spools

Choose **False** to maintain the existing spool objects. **False** is the default option. Choose **True** to delete the existing spool objects and create new spool objects to replace them.

Maximum Length

Provides the maximum length of a spool for oversizing calculation purposes.

Maximum Width

Provides the maximum width of a spool for oversizing calculation purposes.

Maximum Height

Provides the maximum height of a spool for oversizing calculation purposes.

Spool Break By Control Point

Specifies how spools should break.

- **Ignore Control Points** - Ignores the control points during spooling and uses intrinsic or natural breaking points.

- **Break at Control Points** - Breaks at the normal intrinsic line break *and* at control points.

- **Break Only at Control Points** - Breaks only at control points, and disregards any intrinsic line breaks.

NOTE You place control points using the **Insert > Control Point** command. Set the control point **Subtype** to **Duct Break Point**.

Log Tab (Duct Spool Generation Dialog Box)

Displays a log of the duct spooling process. To open the log go to %temp% and locate *spool.log*.

Before

Lists all the spools that existed in the model before you ran the last spooling process. This is the same list of spools that displays if you select this tab before processing spools. Expand this selection to see a list of existing spools. If no spools exist, you will see this logo: bSpools.

To Do List

Lists spools that have objects in the **To Do List**. The spools cannot be created until you fix the objects on the **To Do List**. Click **View > To Do List** (or press CTRL+T) to view the **To Do List**.

Modified

Lists all the spools that were modified during the last spooling process. Expand this selection to see a list of the modified spools.

New

Lists all the spools that were created during the last spooling process. Expand this selection to see a list of the new spools.

NOTE Clicking a spool, ducting system, or duct part in these lists highlights it in the model.

Create a duct spool

1. Select a duct connection, and then click **Insert** > **Control Point**.

    a. Set **Type** to **Control Point.**

    b. Set **Subtype** to **Duct Break Point**.

2. Place the control point(s) for spooling the system.

3. Click **Generate Spools** on the vertical toolbar.

    a. Select the **Ducting System** or **Planning Block** on the **Spooling** tab.

    b. Select the options you want to use on the **Options** tab.

4. Click **OK**.

5. Select the **Log** tab, and review the options listed there.

Delete a duct spool

1. On the vertical toolbar, click **Select**.

2. In the **Locate Filter**, select **Duct Spools**.

3. Select the **Assembly** tab of the **Workspace Explorer**.

4. Select the spool to delete.

5. Click **Delete**. Parts that were assigned to the deleted spool are automatically reassigned to the deleted spool's parent object in Workspace Explorer.

Edit duct spool properties

1. Select a duct spool in the **Workspace Explorer**, or set the filter to **Duct Spools** and select the spool in the model.

2. Click **Edit > Properties**.

3. Edit the properties as necessary.

Duct Spool Properties Dialog Box

Displays information about the selected duct spool. To select a duct spool, right-click the spool (in the Workspace Explorer or in the model) and select **Properties**.

See Also

Occurrence Tab (Duct Spool Properties Dialog Box) (on page 70)
Relationship Tab (on page 104)
Configuration Tab (on page 98)

Occurrence Tab (Duct Spool Properties Dialog Box)

Displays instance-specific information about the spool.

Category

Select the properties that you want to view for the object. Currently, only **Standard** properties are available for spools.

Standard

Displays all the occurrence properties for the spool as defined in the reference data.

Name

Specifies the name of the spool.

Name Rule

Displays how the object was named. If set to **Default Name Rule**, the software named the object using the default naming rule of <ducting system>_Spool<sequence number>. For example, DuctingSystem-03-0001_Spool1 is the first spool of ducting system 03-0001. If set to **User Defined**, you, or someone else, named the object manually.

Sequence ID

Displays the spool sequence ID.

Spool Oversize Flag

Displays **True** if the spool is oversized. Displays **False** if the spool is not oversized. The spool size is set on the *Options Tab (Duct Spool Generation Dialog Box)* (on page 67).

Quick Route

⊢⊣ Joins two existing duct segments in the model. You can connect the duct segments by selecting an end feature, a nozzle, a straight feature, or a surface mounted component such as a hole. The software displays all possible route paths between the selected *from* and *to* points.

Path Options

The software displays only the applicable path options based on the location and orientation of the selected end points in the model. The default option is **Join Direct** ⬚. The software remembers the last used path and sets it as the default option for the next operation. However, if the last used path is not applicable, the default option is reverted to **Join Direct** ⬚.

★ IMPORTANT The software always computes the paths along the active co-ordinate axes.
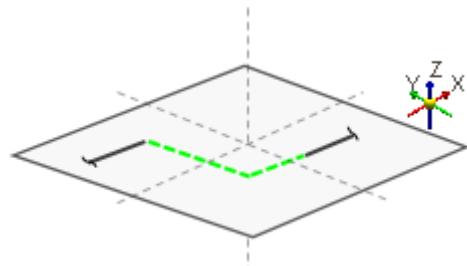
Same axis: If both *from* and *to* end points lie along the same axis, then the software displays only **Join Direct** ⬚.
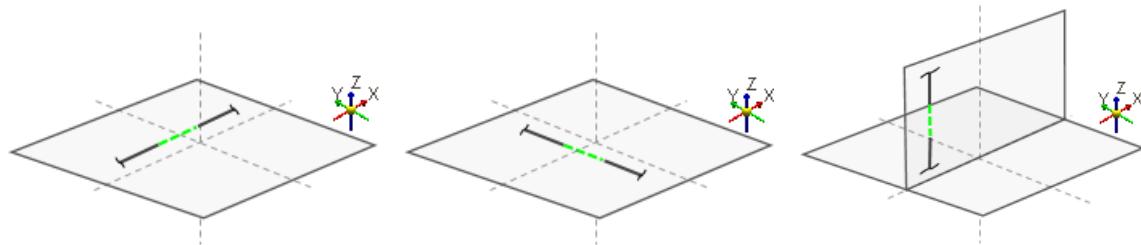
Same plane: If the *from* and *to* end points exist in the same plane, then the software displays the following options:
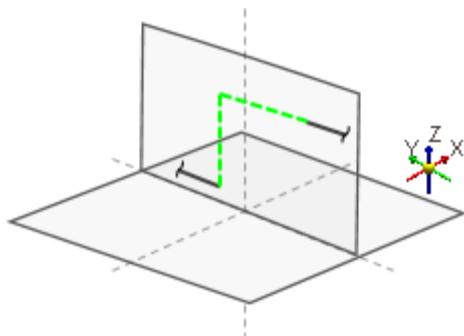
XY Plane:

⬚	XY
⬚	YX
⬚	Join Direct

YZ Plane:

	YZ
	ZY
	Join Direct

ZX Plane:

	XZ
	ZX
	Join Direct
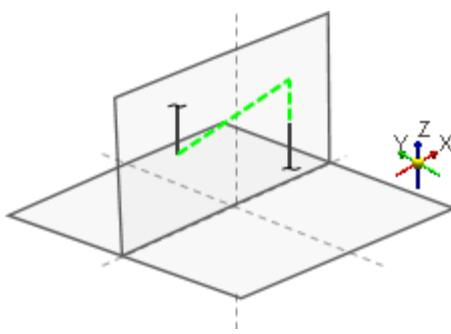
Different planes: If the *from* and *to* end points exist in different planes, then the software displays the following options:

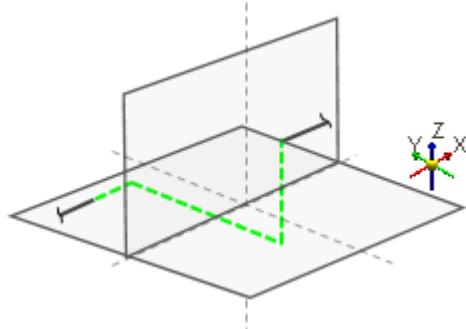|				
	XYZ			**Y-ZX**
	XZY			**Z-XY**
	YZX			**YZ-X**
	YXZ			**ZX-Y**
	ZXY			**XY-Z**

| ZYX		Join Direct
X-YZ		

Minimum Distance Between End Points

Make sure to maintain a minimum distance between the two end points along each axis to avoid skews. The distance between the *from* and *to* end points should facilitate proper placement of the turn features. Insufficient distance might cause skews. The minimum distance is based on the dimensions of the selected route objects.

Fast Compute

In fast compute mode, the elbows or turns compute graphics are not rendered while in dynamic display. By default, the software does not use fast compute mode to dynamically display the compute graphics.
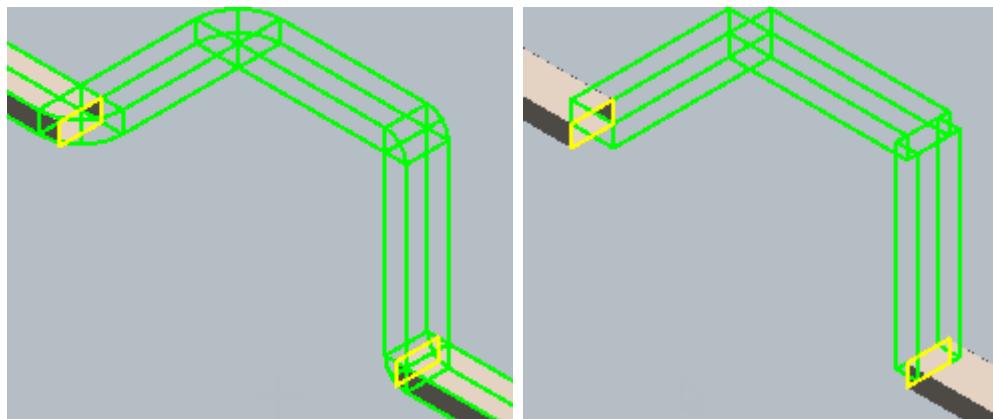
Fast Compute turned off   **Fast Compute** turned on

Navigating the Path Options

When you hover the mouse on a path option, the software dynamically displays the compute graphics for that path option. You can also press Tab or use the mouse scroll-wheel to navigate across the path options. Alternatively, you can also use the arrow keys to navigate. As you navigate, the software dynamically updates and displays the graphics.

Quick Route Duct Ribbon

Join From

Specifies the starting end point.

Join To

Specifies the terminating end point.

Path Options

Displays all possible route path options to join the two end points. The first path option displayed on the menu is the default option.

★ **IMPORTANT** The software always computes the paths along the active co-ordinate axes.

- **Join Direct** - Joins the *from* and *to* end points directly with a one-segment run, irrespective of the axes.

- **XY** - Joins the *from* and *to* end points with the first segment run along the X-axis (E-axis), and then with the second segment along the Y-axis (N-axis).

- **YX** - Joins the *from* and *to* end points with the first segment run along the Y-axis, and then with the second segment along the X-axis.

- **YZ** - Joins the *from* and *to* end points with the first segment run along the Y-axis, and then with the second segment along the Z-axis (El-axis).

- **ZY** - Joins the *from* and *to* end points with the first segment run along the Z-axis, and then with the second segment along the Y-axis.

- **XZ** - Joins the *from* and *to* end points with the first segment run along the X-axis, and then with the second segment along the Z-axis.

- **ZX** - Joins the *from* and *to* end points with the first segment run along the Z-axis, and then with the second segment along the X-axis.

- **X-YZ** - Joins the *from* and *to* end points with the first segment run along the X-axis, and then with the second segment along the YZ plane.

- **Y-ZX** - Joins the *from* and *to* end points with the first segment run along the Y-axis, and then with the second segment along the ZX plane.

- **Z-XY** - Joins the *from* and *to* end points with the first segment run along the Z-axis, and then with the second segment along the XY plane.

- **YZ-X** - Joins the *from* and *to* end points with the first segment run along the YZ plane, and then with the second segment along the X-axis.

- **ZX-Y** - Joins the *from* and *to* end points with the first segment run along the ZX plane, and then with the second segment along the Y-axis.

- **XY-Z** - Joins the *from* and *to* end points with the first segment run along the XY-axis, and then with the second segment along the Z-axis.

- **XYZ** - Joins the *from* and *to* end points with the first segment run along the X-axis, the second segment run along the Y-axis, and the third segment run along the Z-axis.

- **XZY** - Joins the *from* and *to* end points with the first segment run along the X-axis, the second segment run along the Z-axis, and the third segment run along the Y-axis.

- **YZX** - Joins the *from* and *to* end points with the first segment run along the Y-axis, the second segment run along the Z-axis, and the third segment run along the X-axis.

- **YXZ** - Joins the *from* and *to* end points with the first segment run along the Y-axis, the second segment run along the X-axis, and the third segment run along the Z-axis.

- **ZXY** - Joins the *from* and *to* end points with the first segment run along the Z-axis, the second segment run along the X-axis, and the third segment run along the Y-axis.

- **ZYX** - Joins the *from* and *to* end points with the first segment run along the Z-axis, the second segment run along the Y-axis, and the third segment run along the X-axis.

Finish

Places a run along the selected route path.

Run

Displays existing duct runs along with the **<New Duct Run>**, **<New/Continue Run>**, **<Select Graphically>** and **More** options.

- **<New Duct Run>** - Displays the **New Duct Run** dialog box. Use this option to create a new duct run to route. If a new duct run is created, all runs associated with the system parent selected on the **New Duct Run** dialog box display in the list.

- **<New/Continue Run>** - Extends an existing duct run if you select the end feature of that duct run. If a run is continued, all runs associated with the system parent of the continued run display in the list. If you do not select an end feature, the **New Duct Run** dialog box is displayed to create a duct run. For more information, see *New Duct Run Properties Dialog Box* (on page 37).

- **<Select Graphically>** - Selects an existing duct run in a graphic view or in the Workspace Explorer.

- **More** - Displays the **Select Duct** dialog box. Use this option to select a duct run that is associated with a different system parent. For more information, see *Select Duct Run Dialog Box* (on page 116).

Fast Compute

Specifies whether or not the software must render complete compute graphics.

What do you want to do?

- *Join two existing ducts* (on page 76)
- *Join two existing ducts at a branch point* (on page 76)
- *Join two existing ducts at a nozzle* (on page 77)

Join two existing ducts

1. Click **Quick Route** ⊢⊩ on the vertical toolbar.

2. Select an end feature from which to extend the duct.

3. Select a terminating end feature or a nozzle.

   The software displays all possible path options based on the location of the selected features. You can navigate through the path options and view the dynamic compute graphics.

4. On the **Path Options** menu, select an option that you want. You can click the option or press Enter to confirm your selection.

   ⊟**NOTE** By default, the software considers the highlighted option as your selection.

5. If necessary, select an appropriate run from the **Run** drop-down list, or proceed to Step 6.

   - Select **<Select Graphically>** to select an existing run in a graphic view or in the Workspace Explorer.

   - Select **<New Duct Run>** to create a new duct run to route. For more information, see *New Duct Run Properties Dialog Box* (on page 37).

   - Select **More...** to select a duct run that is associated with a different duct system. For more information, see *Select Duct Run Dialog Box* (on page 116).

6. Click **Finish**.

   The software joins the two end points along the selected path.

   ⊙ **WARNING** If the selected path results in skews, then the software prompts you with a warning message.

   a. Click **No** to undo the current path selection.

   b. Select another path option, and then click **Finish**.

7. Continue quick routing, or right-click to exit the command.

See Also

Join two existing ducts at a branch point

1. Click **Quick Route** ⊢⊩ on the vertical toolbar.

2. Select an end feature or a duct port from which to extend the duct run.

3. Select a terminating straight feature or header run.

   The software displays all possible path options based on the location of the selected features. You can navigate through the path options and view the dynamic compute graphics.

4. On the **Path Options** menu, select an option that you want. You can click the option or press Enter to confirm your selection.

   ⊟**NOTE** By default, the software considers the highlighted option as your selection.

5. If necessary, select an appropriate run from the **Run** drop-down list, or proceed to Step 6.

   ▪ Select **<Select Graphically>** to select an existing run in a graphic view, or the Workspace Explorer.

   ▪ Select **<New Duct Run>** to create a new duct to route. For more information, see *New Duct Run Properties Dialog Box* (on page 37).

   ▪ Select **More...** to select a pipe run that is associated with a different duct system. For more information, see *Select Duct Run Dialog Box* (on page 116).

6. Click **Finish**.

   The software joins the two end points along the selected path.

   ⚠ WARNING If the selected path results in skews, then the software prompts you with a warning message.

   a. Click **No** to undo the current path selection.

   b. Select another path option, and then click **Finish**.

7. Continue quick routing, or right-click to exit the command.

See Also
Join two existing ducts (on page 76)

Join two existing ducts at a nozzle

1. Click **Quick Route** ▐▌ on the vertical toolbar.

2. Select an end feature or a duct nozzle from which to extend the duct run.

3. Select a terminating duct nozzle.

   The software displays all possible path options based on the location of the selected features. You can navigate through the path options and view the dynamic compute graphics.

4. On the **Path Options** menu, select an option that you want. You can click the option or press Enter to confirm your selection.

   📝 NOTE By default, the software considers the highlighted option as your selection.

5. If necessary, select an appropriate run from the **Run** drop-down list, or proceed to Step 6.

   ▪ Select **<Select Graphically>** to select an existing run in a graphic view or in the Workspace Explorer.

   ▪ Select **<New Duct Run>** to create a new duct to route. For more information, see *New Duct Run Properties Dialog Box* (on page 37).

   ▪ Select **More...** to select a duct run that is associated with a different duct system. For more information, see *Select Duct Run Dialog Box* (on page 116).

6. Click **Finish**.

   The software joins the two end points along the selected path.

   ⚠ WARNING If the selected path results in skews, then the software prompts you with a warning message.

   a. Click **No** to undo the current path selection.

      b.   Select another path option, and then click **Finish**.

7.   Continue quick routing, or right-click to exit the command.

See Also

Join two existing ducts (on page 76)

S E C T I O N   1 0

Disconnect Command

Tools > **Utilities** > **Disconnect** (CTRL+ALT+D)

Use this command to disconnect a section of route network, and modify its topology without disturbing the rest of the network. The software disconnects the selection at boundary connections, and deletes any mating parts and transitions at the boundaries. The software also removes all the relationships of the selection with the rest of the network.

We recommend that you reconnect objects after modifying the selection, to avoid topological errors.

You can disconnect the following objects:

- a duct run

- a set of duct features

- a feature such as a turn feature, a component type along leg feature, or a straight feature.

Permission Group (PG), Approval Status, and Global Workshare Conditions

If you select route objects that belong to a permission group (PG) to which you have full control permission, the software disconnects the selected objects at boundary connections. You can also disconnect at a PG boundary connection if you do not have access to one side of the connection. But, you must have full control permissions to the objects that you select for disconnection.

If an object at the other end of the boundary connection is in a non-working approval state, the software generates a To Do Record for that object. Also, the software generates a To Do Record if the non-working object is in a different workshare location.

Limitations

- You cannot disconnect a branch feature, or an end feature.

- To disconnect a feature on a leg, you must have full control permission to that leg.

- If the selection includes equipment, the software does not disconnect the selection from the equipment nozzle.

- You cannot disconnect a surface-mounted component.

For more information on how the software disconnects objects at boundary connections, see *Disconnecting duct runs using Move* (on page 84).

What do you want to do?

- *Disconnect a duct run* (on page 80)
- *Disconnect a set of duct features* (on page 81)
- *Disconnect a duct feature* (on page 82)

Disconnect a duct run

1. Click **Select** on the vertical toolbar.

2. In the Locate Filter, select **Duct Runs**.

3. Select a duct run from the **Graphic View** or the **Workspace Explorer**.
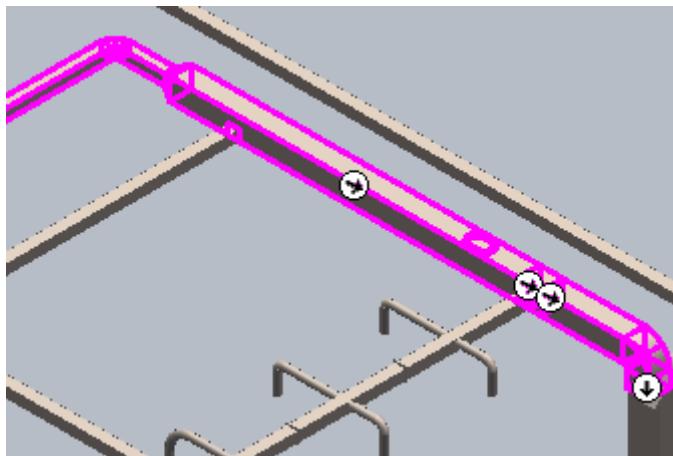
4. Click **Tools** > **Utilities** > **Disconnect**.

   The software disconnects the selection, and prompts you to view the disconnection log.

5. Click **Yes** to view the log.

   A log file displays the disconnection details.

   Total number of objects in the select set : 1

   Total number of features selected : 15

   List of Boundary features identified :

         Duct Along Leg Feature: {00013898-0000-0000-BC00-EFCA334BE70D}
         Duct Branch Feature: {00013899-0000-0000-BD00-EFCA334BE70D}
         Duct Straight Feature: {0001389D-0000-0000-C000-EFCA334BE70D}

   Successfully disconnected all boundaries.

   NOTE The software disconnects the duct run from the rest of the network, and deletes any mating parts or transitions at the boundary connections. The software also removes the relationships between the duct run and the rest of the network.

   TIP Press CTRL+Z, or click **Edit** > **Undo Disconnect**. You can also use **Undo Disconnect** on the main ribbon bar.

Disconnect a set of duct features

1. Click **Select** 🡒 on the vertical toolbar.

2. In the **Locate Filter**, select **Duct Features**.

3. Select the features from the **Graphic View** or the **Workspace Explorer**.

    💡 TIP Use SHIFT+SELECT to select multiple features. You can also use the *Route Selection Commands* (on page 41).
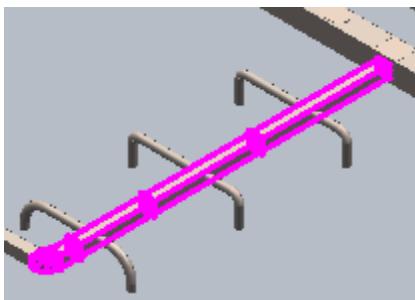
4. Click **Tools** > **Utilities** > **Disconnect**.

    The software disconnects the selection, and prompts you to view the disconnection log.

5. Click **Yes** to view the log.

    A log file displays the disconnection details is displayed.

    ```
    Total number of objects in the select set : 15


    Total number of features selected : 15

    List of Boundary features identified :

            Duct Along Leg Feature: {00013898-0000-0000-7401-EFCA3348E70D}
            Duct Along Leg Feature: {00013898-0000-0000-7301-EFCA3348E70D}
            Duct Along Leg Feature: {00013898-0000-0000-7201-EFCA3348E70D}
            Duct Turn Feature: {0001389F-0000-0000-8201-EFCA3348E70D}

    Successfully disconnected all boundaries.
    ```
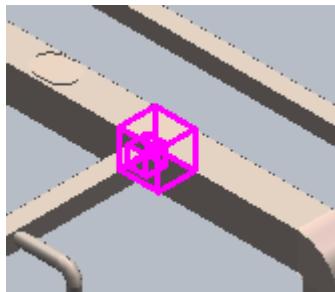
    📄 NOTE The software disconnects the selection from the rest of the network, and deletes any mating parts or transitions at the boundary connections. The software also removes the relationships between the selection and the rest of the network.

    💡 TIP Press CTRL+Z, or click **Edit** > **Undo Disconnect**. You can also use **Undo Disconnect** 🡒 on the main ribbon bar.

Disconnect a duct feature

1. Click **Select** on the vertical toolbar.

2. In the **Locate Filter**, select **Duct Features**.

3. Select a feature from the **Graphic View** or the **Workspace Explorer**.

4. Click **Tools** > **Utilities** > **Disconnect**.

    The software disconnects the selection, and prompts you to view the disconnection log.

5. Click **Yes** to view the log.

    A log file displays the disconnection details.

```
Total number of objects in the select set : 1


Total number of features selected : 1

List of Boundary features identified :

        Duct Along Leg Feature: {00013898-0000-0000-BC00-EFCA3348E70D}

Successfully disconnected all boundaries.
```

NOTE The software disconnects the feature from the rest of the network, and deletes any mating parts or transitions at the boundary connections. The software also removes the relationships between the feature and the rest of the network.

TIP Press CTRL+Z, or click **Edit** > **Undo Disconnect**. You can also use **Undo Disconnect** on the main ribbon bar.

Appendix: Moving at Boundary Connections

If you move a section of a duct network, the software modifies and disconnects the duct network as necessary to maintain the ducting system design intent.

See Also
Connecting duct runs using Move (on page 83)
Disconnecting duct runs using Move (on page 84)

Connecting duct runs using Move

★ **IMPORTANT** To connect two duct runs using **Move** ⊕:

- For inline connections, the two duct run ends must be collinear to each other.

- For branch connections, the header and branch runs must be orthogonal to each other.

- There should be sufficient space at the connection to accommodate the connecting part. If the space is not sufficient the software does not make a connection and displays a message suggesting to connect the duct runs manually.

- The software consumes the first available straight feature of the moved duct run to accommodate the connection thickness, such as a mating part.

- In a partial move, if the connection results in an overlap the software connects the two ends with a To Do Record while maintaining the connectivity.

- If there is no space to accommodate the mating part, the software does not connect the two ends and displays a message suggesting that you connect them manually.

Inline Connection

| No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Working	Full control/ Write
3	Reducer connecting duct runs A and B		
Result: The software connects the duct runs A and B using a system-generated transition. Reduction in duct run B length = length of the transition.			
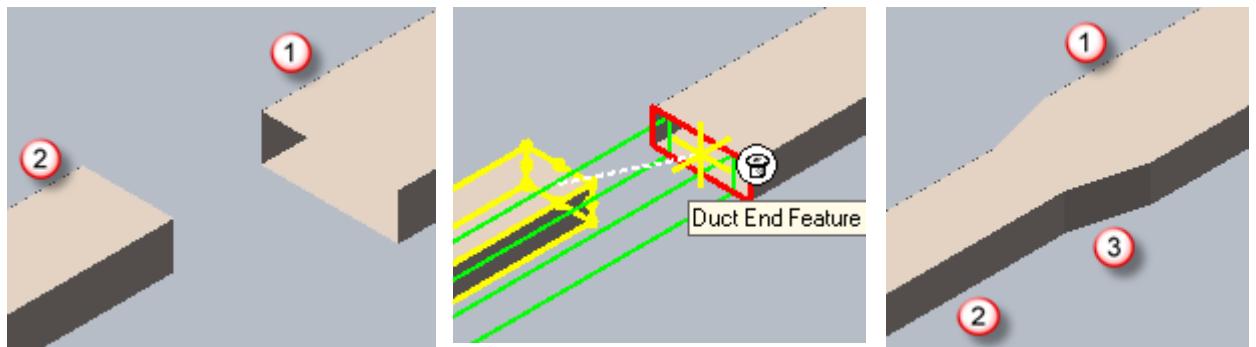
Branch Connection

No.	Route Object	Approval Status	Permission Group Access
1	Header run	Working	Full control/ Write
2	Branch run	Working	Full control/ Write
3	Horizontal tee connection associated with the header		
Result: The software connects the header and branch runs at the tee end feature.			
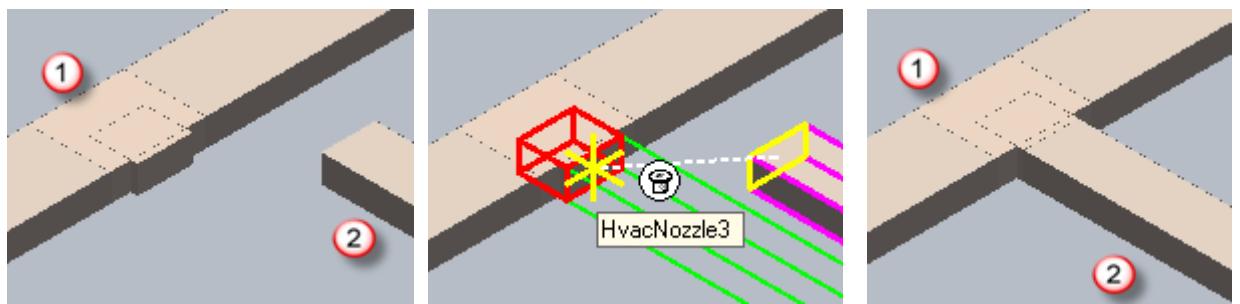
Disconnecting duct runs using Move

When you move a duct run away, the software disconnects all the associated boundary connections. If you move a header run that is connected to an open-ended branch run, the branch run follows the header run. If the branch run does not have a free end, the software disconnects the branch from the header.

If a selection is restricted by adjacent features, use **Disconnect** to disconnect that selection, and then use **Move** ✥ to move the selection without disturbing the rest of the network. For more information see, *Disconnect Command* (on page 79).
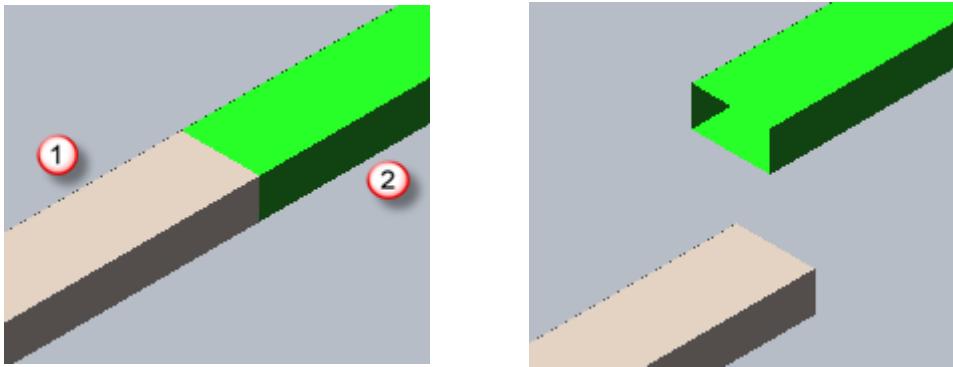
See Also
Duct run to duct run connections (on page 85)
Header to branch connections (on page 87)
Connecting duct runs using Move (on page 83)

Duct run to duct run connections

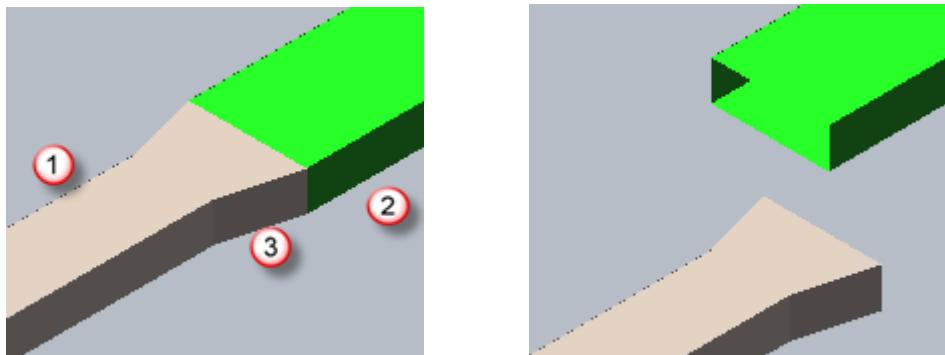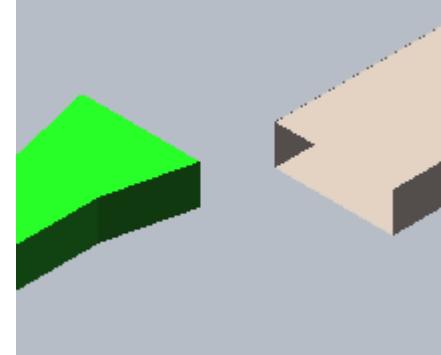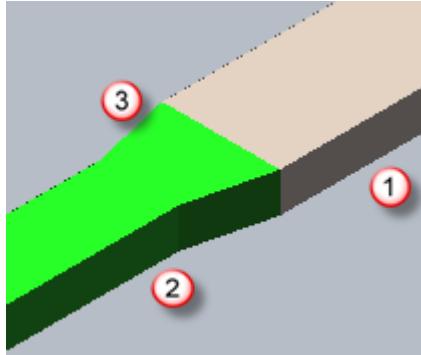| No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Non-working	-
Result: The software disconnects duct run A. You can reconnect it using **Move** ✛.			

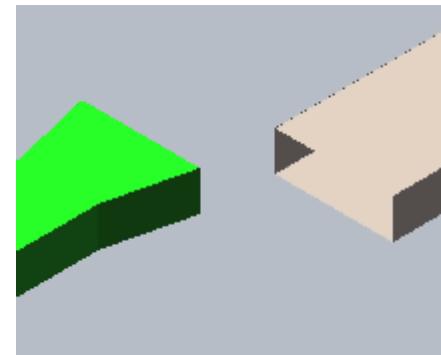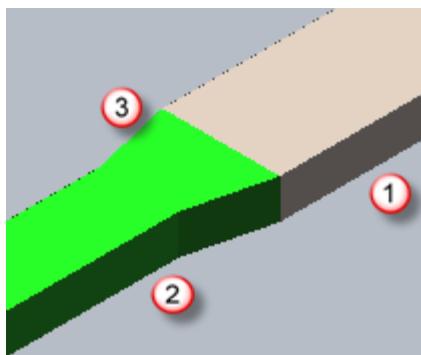| No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Non-working	-
3	Reducer associated with duct run A		
Result: The software disconnects duct run A. You can reconnect it using **Move** ✛.			

No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Non-working	-
3	Reducer associated with duct run B		
Result: The software disconnects duct run A.			

| No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Non-working	-
3	In-line component associated with duct run B		
Result: The software disconnects duct run A, and the tee.			

Header to branch connections

No.	Route Object	Approval Status	Permission Group Access
1	Header run	Non-working	-
2	Branch run	Working	Full control/ Write
3	Tee associated with header run		
Result: The software disconnects the branch run and header run, but does not delete the tee. You can reconnect the branch run using **Move** ✥.			
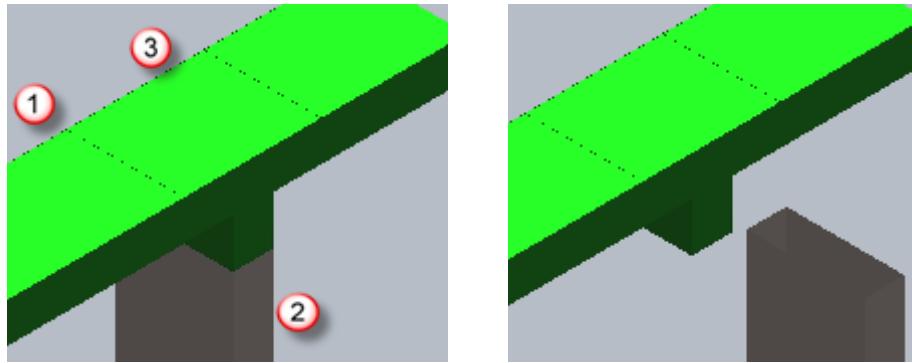
Appendix: Deleting at Boundary Connections

If you delete a duct run that is connected to another duct run or to equipment the software deletes all associated boundary connections. Also, if you delete a header run, or a branch run, the software deletes all associated connections between the header and branch run.

The software deletes the mating parts if they are in working state. If the mating part is in a non-working state or in a different satellite location, the software generates a To Do Record for that part.

You cannot delete a route object in non-working approval status, such as **Approved**, **In Review**, and **Rejected**. But, deleting route objects in a permission group with read-only access has a few exceptions. Also, in a Global Workshare Configuration deleting route objects at a different satellite location has exceptions. These exceptions are illustrated in the following topics.
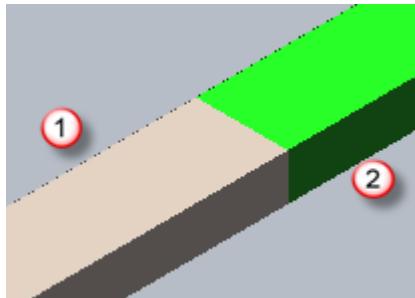
See Also
Duct run to duct run connections (on page 88)
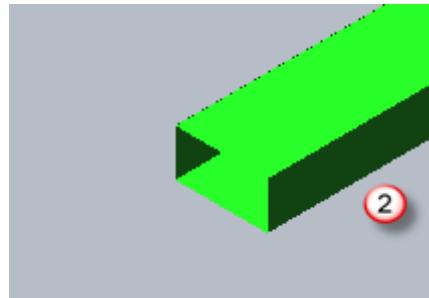*Header to branch connections* (on page 90)

Duct run to duct run connections

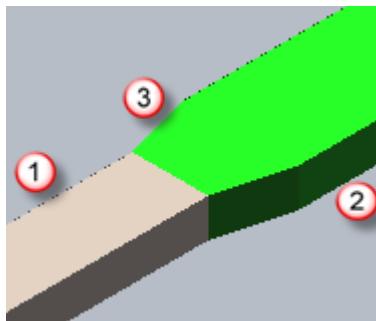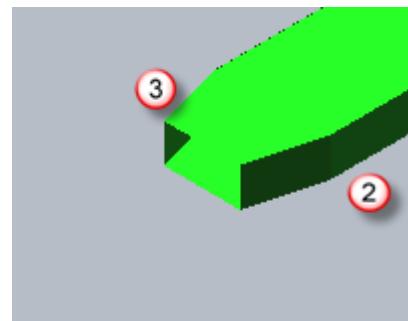| No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Non-working	-
Result: If you delete duct run A, the software also deletes all associated connections.			

| Before deletion | After deletion |

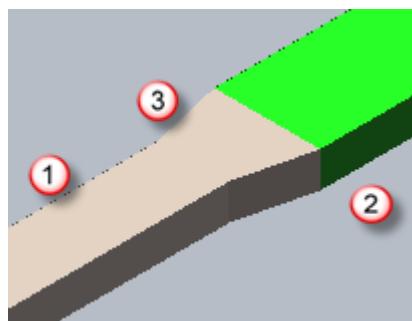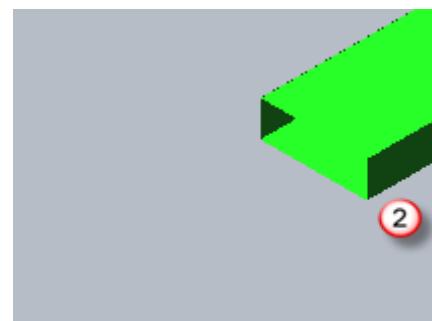| No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Non-working	-
3	Reducing transition associated with duct run B		
Result: If you delete duct run A, the software also deletes all associated connections.			

Before deletion   After deletion

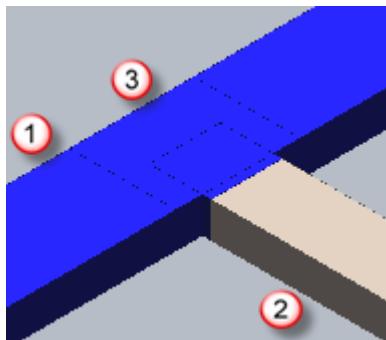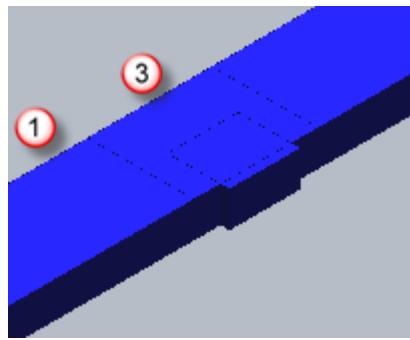| No.	Route Object	Approval Status	Permission Group Access
1	Duct run A	Working	Full control/ Write
2	Duct run B	Non-working	-
3	Reducer associated with duct run A		
Result: If you delete duct run A, the software also deletes all associated objects and connections.			

Before deletion   After deletion

Header to branch connections

No.	Route Object	Approval Status	Permission Group Access
1	Branch run	Working	Full control/ Write
2	Header run	Working	Read-only
3	Tee associated with header run		

Result: If you delete the branch run, the software also deletes all associated connections. The tee is not deleted.

Before deletion   After deletion

No.	Route Object	Approval Status	Permission Group Access
1	Branch run	Working	Full control/ Write
2	Header run	Non-working	-
3	Tee associated with header run		

Result: If you delete the branch run, the software also deletes all associated connections. The tee is not deleted.
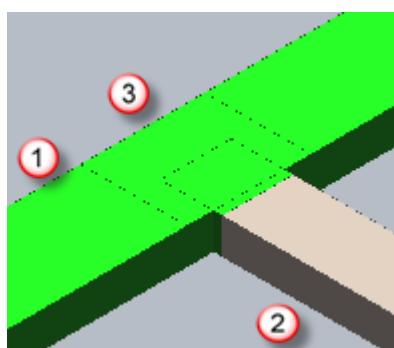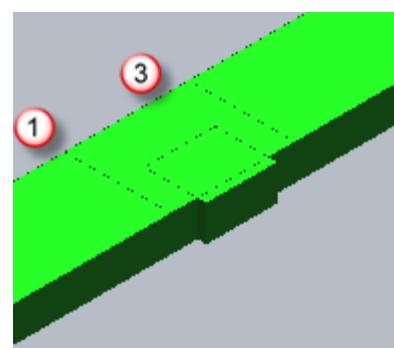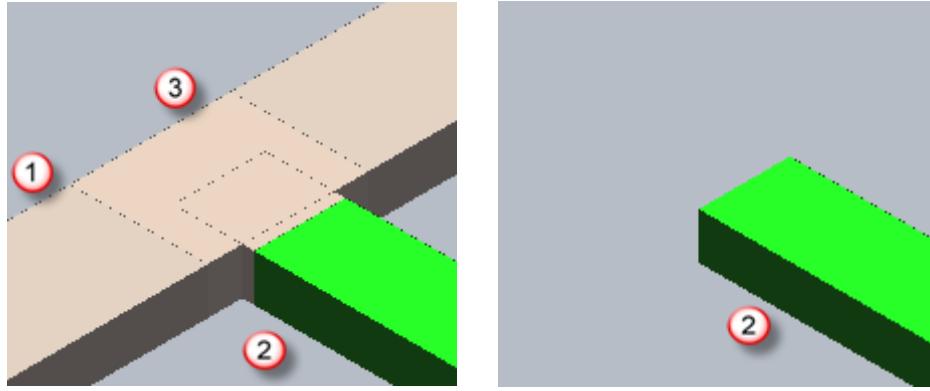

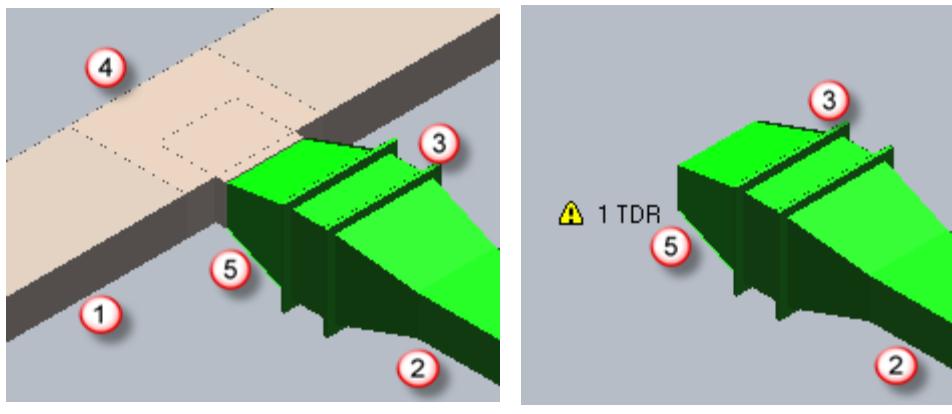Before deletion   After deletion

No.	Route Object	Approval Status	Permission Group Access
1	Header run	Working	Full control/ Write
2	Branch run	Non-working	-
3	Tee associated with header run		
Result: If you delete the header run, the software also deletes all associated connections.			

Before deletion   After deletion

No.	Route Object	Approval Status	Permission Group Access
1	Header run	Working	Full control/ Write
2	Branch run	Non-working	-
3	In-line component associated with branch run		
4	Reducing tee associated with header run		
5	Mating reducer associated with branch run		
Result: If you delete the header run, the software also deletes all associated objects and connections. The software does not delete the mating reducer, and generates a To Do Record for the reducer. You must have Write access to the reducer to update the To Do Record.			

Before deletion   After deletion

Flow Calculator

The Flow Calculator provides a tool for you to complete partial calculations to choose the cross section or to estimate the flow rate. This tool is not an HVAC analysis software. Although the software runs its main calculations of an HVAC system at the diagram stage, you can work with the flow rates during the routing stage.

The values are not connected to the run values. The Flow Calculator estimates for parts, not for the duct run.

To estimate sizes, the process must account for the frictional and dynamic resistance to air flow. Fluid flow is used to correlate pressure changes with flow rates and the nature of the duct. For a given duct, the pressure drop for a given flow rate is needed.

The inputs that you record on the **Calculate Flow** dialog box include duct flow rate, maximum allowed velocity, and pressure loss. If you type flow rate and velocity, the output is diameter (circular) and pressure loss per length. If you type flow rate and pressure loss per length, the output is diameter (circular) and velocity. If you input flow rate and diameter (circular), the output is velocity and pressure loss per length. Also, the software estimates the equivalent rectangular cross section based on the input aspect ratio.

You can display the **Calculate Flow** dialog box by clicking **Tools > Flow Calculator**.

Assumptions

- The software processes the calculations based on air flowing in the duct at standard atmospheric conditions (temperature at 70° F, and air pressure at 14.7 psi).

- The Flow Calculator estimates diameter, pressure loss, flow rate, and velocity only in uniform straight features. The software does not estimate on the basis of fittings, size changes, direction changes, or obstructions. For additional information on pressure loss in fittings, refer to a handbook with industry standards.

- The Flow Calculator is based on the equal friction method of duct design. The equal friction method is commonly used in the industry in systems with low to moderate velocities, based on a friction drop per 100 feet of duct. For this reason, the duct length estimates in the software are based on 100 feet length (or 1 meter in metric calculations).

- Friction factor requires a duct roughness based on duct material. The Flow Calculator uses a medium-smooth material with a roughness factor of 0.0003 feet (like galvanized steel). You can perform suggested estimations for galvanized steel and apply correction factors to the results for other material types.

- The software performs estimates without the presence of a fan.

- All estimates are based on straight sections with no loss coefficients available for fittings.

- The software uses imperial units. Before calculating results, the software converts values that you type to the proper imperial units using conversion factors. You can review the results in the units sets by clicking **Tools > Options** and selecting the **Units of Measure** tab.

- The width ratio (or aspect ratio) refers to the ratio of depth to width for a rectangular cross section.

See Also

Calculate Flow Dialog Box

Provides a tool to perform the various flow rate estimations based on predefined processing in the software. This tool is not an HVAC analysis software. You use the Flow Calculator when you select duct size or confirm the flow rate of routed duct.

This dialog box provides three types of calculation methods. After you change the method, the input and output values change dynamically. After clicking the **Calculate** button with required input values, the software completes the calculation and displays the results on the dialog box.

Method

Organizes the possible options to use in the estimation. The input and output controls change dynamically, depending on the method that you select. Select one of the following methods:

- **Flow rate and velocity >= diameter and loss per length** - Serves as the default setting.

- **Flow rate and loss per length >= diameter and velocity**

- **Flow rate and diameter >= velocity and loss per length**

Calculation values

Organizes the values used in the estimation. The boxes under the **Inputs** heading contain the values that the algebraic equations use. In the **Results** column, the software displays the outcome of the equations.

Flow rate

Defines the flow rate to use in the estimation. In this context, flow rate is the quantity of fluid flowing per unit of time. Flow rate is used as input for all methods.

Velocity

Defines the velocity to use in the estimation. Velocity is used as input for the first method and used as output for the second and third methods.

Diameter

Defines the diameter to use in the estimation. Diameter is used as output for the first and second methods and used as input for the third method.

Press loss per length

Defines the loss of pressure in a length of a duct run. The value for **Press loss per length** is used as output for first method and third methods and used as input for the second method.

Shape conversion

Organizes the values that change the properties for a rectangular or flat oval feature during the estimation.

Rectangle

Displays a row of values used to estimate for a rectangular feature. The values include **Width ratio** (for each cross section based on the ratio of depth / width), **Corner radius** (of the rectangular cross section), **Width** (which is converted from the diameter), and **Depth** (which is converted from the diameter).

Flat oval

Displays a row of values used to estimate for a flat oval feature. The values include **Width ratio** (for each cross section based on the ratio of depth / width), **Width** (which is converted from the diameter), and **Depth** (which is converted from the diameter).

Calculate

Runs the equations based on the values that you have entered when you click this button.

Estimate flow rate

1. Click **Tools > Flow Calculator**.

2. On the **Calculate Flow** dialog box, select one of the following methods:

   - **Flow rate and velocity >= diameter and loss per length**

   - **Flow rate and loss per length >= diameter and velocity**

   - **Flow rate and diameter >= velocity and loss per length**

3. If you selected the first method, type the values in the **Flow rate** and **Velocity** boxes.

4. If you selected the second method, type the values in the **Flow rate** and **Press loss per length** boxes.

5. If you selected the third method, type the values in the **Flow rate** and **Diameter** boxes.

6. Click **Calculate**.

7. Review the results for the first method in the **Diameter** and **Press loss per length** boxes, for the second method in the **Diameter** and **Velocity** boxes, and for the third method in the **Velocity** and **Press loss per length** boxes.

8. Review the possible combination of shape conversion for a rectangle and flat oval ducts. Values dynamically change in the **Width ratio**, **Corner radius**, **Width**, and **Depth** boxes.

9. For additional estimates, change the values in the **Inputs** boxes.

10. When you have completed the estimates, click **Close**.

Determining the Center of Gravity and Duct Weight

Duct fittings typically are manufactured from sheet metal and are generated at the job site or in the shop. The weight is calculated based on the sheet metal characteristics and volume. The amount of material depends on the surface area used to create the part and thickness. For parts generated by the catalog, the software uses reference data to calculate the weight and center of gravity.

Duct weight depends on the construction material, material thickness, cross section and cross section size. Each ducting material has a defined value for the material weight per area per thickness. For instance, galvanized sheet metal weighs 40.82 lb./ft.^{2}, per 1-inch of thickness.

The following table summarizes the duct weight values (in lb. / ft.^{2} / in) of common sheet metal material in imperial units.

Common Sheet Metal Material	lb./ft.^{2}/in
Galvanized sheet metal weight	40.82
Uncoated steel sheet metal weight	41.82
300 series stainless steel sheet metal weight	41.99
400 series stainless steel sheet metal weight	41.20
Aluminum sheet thickness (ALLOY 3003-H14)	14.256

You can calculate the center of gravity on a feature level by assuming a uniform weight. However, to determine the center of gravity for a part consisting of multiple features, you use calculations that deal with varying or non-uniform forces (called barycentric calculations). The calculation normally involves three items. When you change a value for one of the items, the other two items also change in a predictable manner.

Duct Run and Feature Properties Dialog Boxes

The **Properties** dialog boxes in the HVAC task provides designers with the precise level of control and detail necessary to create a complex HVAC system. Through manipulation of various part specifications, you can design a system that matches your ducting needs exactly by choosing sizes, materials, and thickness to guarantee a perfect fit to your vision.

Using these capabilities provides for a higher level of customization than is possible if you simply choose parts from a catalog. By specifying properties that each part of the system must possess, you receive a much more exact match with the original design. The **Properties** dialog boxes put you in total control of the design process, down to the smallest detail of your system.

For surface-mounted components, you can open the **Properties** dialog box by clicking **Edit > Properties** on the menu. Also, during any of the procedures associated with the HVAC task, you can click **Properties** 🖼 on the horizontal ribbon to open the **Properties** dialog box. You can change the properties of an HVAC feature at any time during or after the routing process.

📝 **NOTE** For routing tasks, you should apply style rules to parts - not to runs or features. During processing by the software, parts of a run correspond most closely to stock parts. Therefore, for the filter for the run, you need to select **Duct Runs**, instead of **Duct Parts** for the basis object. Rules for HVAC components and instruments require several object types.

Common Property Tabs

The software displays some common property tabs on the properties dialog boxes for all HVAC objects. Instead of repeatedly listing the common tabs with each HVAC object property dialog box, they are documented here for easy reference.

Configuration Tab (on page 98)
Cross Section Tab (on page 99)
Definition Tab (on page 101)
Notes Tab (on page 101)
Occurrence Tab (on page 102)
Relationship Tab (on page 104)

Configuration Tab

Displays the creation, modification, and status information about an object.

📄 NOTE You cannot define the filters using the **Configuration** tab.

Plant

Displays the name of the model. You cannot change this value.

Permission Group

Specifies the permission group to which the object belongs. You can select another permission group, if needed. Permission groups are created in Project Management.

Transfer

Reassigns ownership of the selected model objects from their current permission group to another satellite or host permission group. This option is only available if the active model or project is replicated in a workshare configuration. The option is not available if all of the objects in the select set already belong to another location and are non-transferable. For more information, see *Transfer Ownership Dialog Box* in the *Common User's Guide*.

📄 NOTE The **Transfer** option does not apply to the filters and surface style rules.

Approval State

Specifies the current status of the selected object or filter. The display depends on your access level. You might be unable to change the status of the object. The list is defined by the ApprovalStatus codelist.

📄 NOTE You can only edit or manipulate an object with a status of **Working**.

Status

Specifies the location of the object in the workflow process. Changing this property sets the **Approval State**. The list is controlled by the ApprovalReason codelist in the ApprovalReason.xls file. You must bulkload this file. For more information, see *ApprovalReason* in the *Reference Data Guide*.

Date Created

Specifies the creation date of the object.

Created by

Specifies the name of the person who created the object.

Date Last Modified

Specifies the date when the object was last modified.

Last Modified by

Specifies the name of the person who last modified the object.

Transfer Ownership Dialog Box

Allows you to specify a new location and permission group for the selected model objects.

Current location

Displays the name of the location with which the current permission group is associated. All of the objects in the select set must belong to the same location.

Current permission group

Displays the name of the permission group with which the selected objects are currently associated. If all of the objects in the select set do not belong to the same permission group, this box appears blank.

New location

Specifies the name of the location to which you want to assign the objects. In a global workshare configuration, this box lists all the locations in which you have write access to one or more permission groups. The selection in this box filters the entries in the **New permission group** box.

New permission group

Specifies the new permission group to which to assign the selected objects. If you specify a value in the **New location** box, this list displays all permission groups to which you have write access in the selected location. If you do not specify a value in the **New location** box, this list includes all permission groups to which you have write access in all locations except the current location. This box is blank if you do not have write access to any permission groups at any locations other than the current one.

NOTE We strongly recommend that administrators follow naming convention rules that include the location as a prefix in the permission group name.

Cross Section Tab

Displays the size and view perspective parameters for the cross-section. The options available on this tab depend upon the type of feature (such as turn, straight, or transition) that you have selected and the cross-section type (such as rectangle or round).

icon appears in the Value box if the duct cross-section property value is inherited from the duct run to which the feature belongs.

Calculate button

Displays the **Calculate Flow** dialog box. For more information, see *Calculate Flow Dialog Box* (on page 94).

Position

Indicates whether the properties are for the start of the transition, or the end of the transition.

Cross Section

Defines the shape of the cross-section for the feature. You can select **Rectangle**, **Round** and **Flat Oval** shapes. If you do want the feature to inherit the duct specification from the duct run, select **User Run CrossSection**.

Width

Defines the width dimension of the cross-section. The values stored in the reference data determine the list of options. The list displays only the values that are valid for the current depth. If the depth is not defined (for example, the **Depth** box is blank), the width size is based on the default width ratio. You can type a value if you have selected a user-defined specification. Select **<Clear>** to undo the default width ratio filtering and display all the depth values listed in the reference data.

Depth

Defines the depth of the cross-section. You can type only values that are greater than or equal to the width value, if defined. The values stored in the reference data determine the list of options. The list displays only the values that are valid for the current width. If the width is not defined (for example, the **Width** box is blank), the depth size is based on the default width ratio. You can type a value if you have selected a user-defined specification. Select **<Clear>** to undo the default width ratio filtering and display all the depth values listed in the reference data.

Diameter

Defines the diameter of the cross-section for the feature and is available for **Round** shape. The values stored in the reference data determine the list of options. You can also type a value that is not on the list if you have selected a user-defined specification.

Corner Radius

Determines the radius of the cross-section and is available for **Rectangle** shape.

Orientation Angle

Defines the orientation of the duct run by specifying the angle between the local axis of the feature and the width axis. A value of 0 results in a feature with the width horizontal and the depth vertical. A value of 90 degrees results in the width vertical and the depth horizontal. The value for an angle ranges from 0 to 360 degrees.

Non-Standard CrossSection

Indicates whether the cross-section values are in the specification defined by the system. This property is read-only.

- **TRUE** - Specifies that the cross-section values are not in the specification defined by the system.

- **FALSE** - Specifies that the cross-section values are in the specification defined by the system.

Number of Vanes

Defines the number of vanes used for branches during routing. To add the weight and center of gravity of the branches vanes in the branches feature calculations, assign the values for the duct material and thickness of the branches feature as the values for the vane material and thickness equals (that is, these values are equal). The range of values for **Number of Vanes** includes non-negative integers.

Vane Length

Defines the length of the specified vanes.

Definition Tab

Displays information about the specific component. For more information about components defined in the reference data, see the *HVAC Reference Data Guide* available from **Help > Printable Guides**.

See Also
Duct Part Properties Dialog Box (on page 105)
Duct Component Properties Dialog Box (on page 116)

Notes Tab

Creates and edits user-definable text placed by the designer on an object in the model. The notes provide special instructions related to the object for the fabricator and are available in downstream tasks. For example, the notes appear in two-dimensional drawings and within design review sessions.

NOTE Only one note of a given kind from a given object can be shown on a drawing. For example, if there are two fabrication notes on a piping part, then only one of the notes shows on the drawing. It is important to know about and to consider this situation when defining notes on an object in the modeling phase. For example, you can display one Fabrication note and one Installation note by defining two separate labels for the two kinds of notes.

Key point

Specifies the key point on the object to which you want to add a note.

Notes at this location, listed by name

Lists all notes for the selected key point on the object.

Date

Displays the date that the note was created. The system automatically supplies the date.

Time

Displays the time that the note was created. The system automatically supplies the time.

Purpose of note

Specifies the purpose of the note.

Author

Displays the login name of the person who created the note. The system automatically supplies this information. You cannot change this information.

Note text

Defines the note text. The software does not limit the length of the note text.

Show dimension

Indicates that the note generates a dimension.

If you are displaying the properties for a Support component, then a dimension can be included for the component in the Support drawings, if you select the **Show dimension** option. The note must be associated with one of the key points for the Support component. It is recommended that you set the **Purpose of note** as **Fabrication**, but this is not a requirement. The note **Name** and **Note text** are not used when you select this option.

New Note

Creates a new note on the object.

Standard Note

Displays a list of standard notes from which you can select. This feature is not available in this version.

Highlight Note

Highlights the note in the graphic view so that you can easily find the note and the object to which it is related. This feature is not available in this version.

Delete Note

Deletes the currently displayed note.

Occurrence Tab

Displays instance-specific information about the object. Available options depend upon the **Category** selected. For more information about occurrences defined in the reference data, see the *HVAC Reference Data Guide* available from **Help > Printable Guides**.

Preview button

Displays a preview of the object.

Standard

Name

Displays the occurrence name of the object.

Modeled Length

Displays the length of the object in the model. This property is not displayed for all occurrences.

Reporting Requirements

Displays the reporting requirement for the selected object. To add, edit, or remove values that are available for selection, edit the **Reporting Type** select list in the Catalog task.

Reporting Type

Displays the type of reporting. To add, edit, or remove values that are available for selection, edit the **Reporting Type** select list in the Catalog task.

Weight and CG

Displays the center-of-gravity and the weight of the selected object. The software includes the insulation weight in the calculated weight. If you key-in the weight yourself, you must include the insulation weight in the weight value that you type. The center-of-gravity locations are displayed in global system coordinates along the X-, Y-, and Z-axes.

Dry Weight

Displays the dry weight of the object.

Wet Weight

Displays the wet weight of the object.

Dry CG X

Displays the X-axis location of the dry center-of- gravity.

Dry CG Y

Displays the Y-axis location of the dry center-of- gravity.

Dry CG Z

Displays the Z-axis location of the dry center-of- gravity.

Wet CG X

Displays the X-axis location of the wet center-of- gravity.

Wet CG Y

Displays the Y-axis location of the wet center-of- gravity.

Wet CG Z

Displays the Z-axis location of the wet center-of- gravity.

Dry WCG Origin

Specifies if the software calculates the dry weight center-of-gravity origin location or if you specify the origin location yourself. Options include **Defined** or **Computed.** To key in values, you must select **Defined**.

Wet WCG Origin

Specifies if the software calculates the dry weight center-of-gravity origin location or if you specify the origin location yourself. Options include **Defined** or **Computed.** To key in values, you must select **Defined**.

Fabrication and Construction

Fabrication Requirement

Select the fabrication requirement for the selected object. If you want to add, edit, or remove values that are available for selection, edit the **Fabrication Type** select list in the Catalog task.

Fabrication Type

Select the fabrication type for the selected object. If you want to add, edit, or remove values that are available for selection, edit the **Fabrication Type** select list in the Catalog task.

Construction Requirement

Select the construction requirement for the selected object. If you want to add, edit, or remove values that are available for selection, edit the **Construction Type** select list in the Catalog task.

Construction Type

Select the construction type for the selected object. If you want to add, edit, or remove values that are available for selection, edit the **Construction Type** select list in the Catalog task.

See Also
Duct Part Properties Dialog Box (on page 105)
Duct Component Properties Dialog Box (on page 116)

Relationship Tab

Displays all objects related to the selected object for which you are viewing properties. For example, if you are viewing the properties of a pipe run, the related pipeline, features, parts, associated control points, hangers or supports, and equipment display on this tab. All WBS assignments, including project relationships, appear on this tab.

Additional examples for marine relationships are as follows:

- For plate and profile system properties, the related bounded objects, bounding objects, and connections are shown.

- For plate and profile system part properties, parent systems are shown.

- For assembly connection properties, all connected objects are shown.

- For the properties of a frame connection on a member, supported, supporting, and auxiliary supporting parts are shown.

- For split connection properties, the parent and auxiliary supporting parts are shown.

Name

Specifies the name of the object.

Type

Specifies the type of object. To change the options on the list, edit the **Weld Type** select list in Catalog.

Go To

Displays the properties of the selected object.

Duct Run Properties Dialog Box

Specifies properties for the duct run.

General Tab (Duct Run Properties Dialog Box) (on page 104)
Cross Section Tab (on page 99)
Relationship Tab (on page 104)
Configuration Tab (on page 98)
Notes Tab (on page 101)

General Tab (Duct Run Properties Dialog Box)

Specifies general property values for duct runs.

System

Defines the system to which the duct run belongs.

Name

Defines the name assigned to the duct run.

Name Rule

Specifies the name rule to use for the duct.

Specification

Defines the specification assigned to the duct run.

📝 **NOTE** Standard specification has allowable cross-sections defined by the system. You can only select the cross-section values from the list displayed. User defined specification has the allowable cross-sections defined by the system and it also allows you to key-in cross-section values that are not on the list.

Max. Recommended Velocity

Defines the maximum air flow velocity for the duct run.

Max. Recommended Pressure Loss

Defines the maximum pressure loss recommended for the duct run.

Material

Defines the material assigned to the duct run.

Thickness

Defines the thickness of the duct material.

Insulation Material

Defines the insulation material. The list contains the last five insulation materials selected. Click **More** to browse the catalog for the insulation material to use. If you set this field to **Not Insulated**, the **Insulation Thickness** field is disabled.

Insulation Thickness

Defines the thickness of the insulation material. The list contains the insulation thickness values for the insulation material from the duct specification. This field is not available if you do not have an insulation material defined.

Flow Direction

Select the flow direction for the duct run. The flow directional indicators are listed below:

🔄 Bi-directional

↖ Upstream

↘ Downstream

🚫 No flow

❓ Undefined

Duct Part Properties Dialog Box

Reviews or changes the details for the duct part.

See Also
Occurrence Tab (on page 102)
Definition Tab (on page 101)

Duct Properties Dialog Box

Reviews or changes the details for the duct part.

See Also

General Tab (Duct Properties Dialog Box)

Sets options for the duct.

System

Defines the system to which the duct belongs.

Name

Defines the name assigned to the duct.

Name Rule

Specifies the name rule to use for the duct.

Specification

Defines the specification assigned to the duct.

NOTE Standard specification has allowable cross-sections defined by the system. You can only select the cross-section values from the list displayed. User-defined specification has the allowable cross-sections defined by the system and it also allows you to key-in cross-section values that are not on the list.

Max. Recommended Velocity

Defines the maximum air velocity for the duct.

Max. Recommended Pressure Loss

Defines the maximum pressure loss for the duct.

Material

Defines the material assigned to the duct.

Thickness

Defines the thickness of the duct material.

Insulation Material

Defines the duct insulation material. The list contains the last five insulation materials selected. Select **More** to browse the catalog for the insulation material to use. If you set this field to **Not Insulated**, the **Insulation Thickness** field is disabled.

Insulation Thickness

Defines the thickness of the duct insulation material. The list contains the insulation

thickness values for the insulation material from the duct specification. This field is not available if you do not have an insulation material defined.

Flow Direction

Defines the air flow direction for the duct. You can select **Upstream**, **Downstream**, **Bidirectional**, **No flow**, or **Undefined**. The default value is **Undefined**.

Defaults Tab (Duct Properties Dialog Box)

To display the **Defaults** tab, select a duct in your drawing, right-click, and select **Properties**. The **Duct Properties** dialog box displays. Click the **Defaults** tab to view the available properties.

Transition Angle

Defines the default transition angle used to calculate transition length. Type a value in the current angle measurement. The software uses this value to calculate transition length by using the following formula:

L = (W1 - W2) / tan x (where x is equal to this transition wall angle that you define)

Editing the transition angle does not affect any transitions that you placed previously. To modify the transition angle for existing transitions, use the **Edit Properties** page for the transition objects. The default transition length is 15 degrees.

Bend Radius Multiplier

Defines the turn radius that the software will use for turns while routing as a multiplier function of the duct dimension in the plane of the turn. The dimension used is the diameter for round cross section, the width dimension, or the depth dimension, depending upon the plane of the turn. If you change the bend radius multiplier, the software automatically changes the throat radius value.

The list displays the last five values in numeric order. If this is the first time in the session file, the **Bend Radius Multiplier** is the default from the active specification.

Throat Radius

Defines the throat radius dimension for the turn feature. If you change the throat radius, the software automatically updates the bend radius multiplier. The list displays the last ten radii used.

Minimum Straight Length

Defines the shortest allowed length of a straight feature that extends outside a coupling.

Turn Part

Defines the type of turn part and its radius.

Branch Part

Defines the type of branch part that you use when you are routing duct.

Depth/Width Ratio (Rect)

Displays the depth and width ratio for rectangular ducts.

Depth/Width Ratio (Flat Oval)

Displays the depth and width ratio for flat oval ducts.

Radius

Specifies the radius of the turn.

Number of Miters (0-30)

Specifies the number of miters for a turn of 0-30 degrees. You can specify a new number of miters for the angle if needed.

Number of Miters (30-60)

Specifies the number of miters for a turn of 30-60 degrees. You can specify a new number of miters for the angle if needed.

Number of Miters (60-90)

Specifies the number of miters for a turn of 60-90 degrees. You can specify a new number of miters for the angle if needed.

Branch Vanes

Defines the number of vanes in a branch.

Turning Vanes

Defines the number of vanes in a turn.

Vane Length

Defines the length of vanes.

Remember Working Plane

Allows you to choose whether the software remembers the last used working plane. **False** clears the last selected plane so that you must reset the plane each time that you begin routing. **True** remembers the last used working plane. The software then remembers your selection and locks each route onto the plane. The default option is **False.**

When **Remember Working Plane** is set to **False**, the default plane option for **Route Duct** is **No Plane**. Each time that you click a routing command, the system clears the last selected **Plane** option. You must reset the plane option each time that you begin a route.

However, you can set the default behavior to remember the last used working plane by setting **Remember Working Plane** to **True**. The software then locks the route onto the plane that you are using and remembers your selection within that session only.

NOTE This option is available when you are routing duct, piping, cableways, and conduits. Setting this option to **True** when you are in any of these tasks results in an automatic **True** setting for all tasks. Likewise, setting this option to **False** when you are in any of these tasks results in an automatic **False** setting for all tasks.

Duct Along Leg Feature Properties Dialog Box

Displays properties for along leg features for review and editing. A leg is a section of a duct path that starts and ends at an end, turn or offset turn, or branch feature.

Along leg features include take-down joints and components. If the branch and header are in the motion plane, the along leg feature-branch parent function and the branch feature move along the branch leg. If the branch and header are not in the motion plane, the end of the branch leg, the along leg feature-branch parent function, and branch function move to keep the branch

angle constant. Along leg features that are not branches maintain a position at a constant distance from the fixed end of the leg.

See Also

General Tab (Duct Along Leg Feature Properties Dialog Box)

Creates or modifies property values or displays status information about an object. The properties that display depend on the reference data defined for the object. For more information, see the *HVAC Reference Data Guide* available from **Help > Printable Guides**.

Duct Run

Defines the run to which the feature belongs.

Material

Specifies the object material type, such as **Steel - Carbon** or **Steel - High Strength**.

Thickness

Specifies the thickness of the object.

Insulation Material

Specifies the material of the insulation. If **Insulation Specification** is set to use the insulation defined by the equipment object, this field cannot be changed. However, if **Insulation Specification** is manually defined, select the insulation material from those available from the reference data.

The list contains the last five insulation materials selected. Click **More** to browse the catalog for the insulation material to use. If you set this field to **Not Insulated**, the **Insulation Thickness** field is disabled. If you set this field to **Use Run Material**, the along leg feature inherits the insulation material from the duct run.

To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Number of Vanes

Defines the number of vanes used for branches during routing. To add the weight and center of gravity of the branches vanes in the branches feature calculations, assign the values for the duct material and thickness of the branches feature as the values for the vane material and thickness equals (that is, these values are equal). The range of values for **Number of Vanes** includes non-negative integers.

Vane Length

Defines the length of the specified vanes.

Name

Specifies the name of the object.

Part

Defines the part assigned to the leg feature.

Duct End Feature Properties Dialog Box

Reviews or changes general, configuration, and part properties for the end feature in the duct run.

See Also

Configuration Tab (on page 98)
Relationship Tab (on page 104)
General Tab (Duct End Feature Properties Dialog Box) (on page 110)

General Tab (Duct End Feature Properties Dialog Box)

Allows you to set options for adding an end feature into a duct run.

Duct Run

Defines the duct run to which the end feature belongs.

Material

Defines the material for the end feature.

Thickness

Defines the material thickness for the end feature.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Part

Defines the part assigned to the end feature.

Duct Straight Feature Properties Dialog Box

Reviews or changes general, configuration, and cross-sectional properties for a straight feature in a duct run.

See Also

Configuration Tab (on page 98)
Relationship Tab (on page 104)
Cross Section Tab (on page 99)
General Tab (Duct Straight Feature Properties Dialog Box) (on page 111)

General Tab (Duct Straight Feature Properties Dialog Box)

Allows you to set options for adding a straight feature into a duct run.

Duct Run

Defines the duct run to which the straight feature belongs.

Material

Defines the material of which the straight feature is constructed.

Thickness

Defines the thickness of the straight feature material.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Length

Defines the length for the straight feature (for example, **1 ft. 1.06 in**).

Duct Transition Feature Properties Dialog Box

Allows you to review or change details that relate to general, configuration, cross section, and relationship properties for the transition feature in the duct run.

See Also
General Tab (Duct Transition Feature Properties Dialog Box) (on page 54)
Cross Section Tab (on page 99)
Relationship Tab (on page 104)
Configuration Tab (on page 98)

General Tab (Duct Transition Feature Properties Dialog Box)

Displays while working with the **Route Duct** command to create or modify property values or learn status information about a duct run.

Duct Run

Defines the duct run to which the transition is assigned.

Material

Defines the material from which the transition is manufactured.

Thickness

Defines the thickness of the transition material.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Type

Defines the type of transition.

Length

Defines the length of the transition.

Duct Turn Feature Properties Dialog Box

Reviews or changes general, configuration, cross-sectional, and part properties for the turn feature in the duct run.

See Also

Configuration Tab (on page 98)
Relationship Tab (on page 104)
Cross Section Tab (on page 99)
General Tab (Duct Turn Feature Properties Dialog Box) (on page 113)

General Tab (Duct Turn Feature Properties Dialog Box)

Sets options for adding a turn feature into a duct run.

Duct Run

Defines the duct run into which you are inserting the turn feature.

Material

Specifies the material from which the duct turn feature is manufactured.

Thickness

Specifies the thickness of the duct turn feature material.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Type

Defines the type for the turn feature. The list displays the turns allowed for the current specification.

Throat Radius

Defines the throat radius dimension for the turn feature. If you change the throat radius, the software automatically updates the bend radius multiplier. The list displays the last ten radii used.

Bend Radius Multiplier

Defines the turn radius that the software will use for turns while routing as a multiplier function of the duct dimension in the plane of the turn. The dimension used is the diameter for round cross section, the width dimension, or the depth dimension, depending upon the plane of the turn. If you change the bend radius multiplier, the software automatically changes the throat radius value.

The list displays the last five values in numeric order. If this is the first time in the session file, the **Bend Radius Multiplier** is the default from the active specification.

Angle

Displays the angle of the turn. You cannot change the angle.

Number of Vanes

Defines the number of vanes used for branches during routing. To add the weight and center of gravity of the branches vanes in the branches feature calculations, assign the values for the duct material and thickness of the branches feature as the values for the vane material and thickness equals (that is, these values are equal). The range of values for **Number of Vanes** includes non-negative integers.

Vane Length

Defines the length of the specified vanes.

Duct Turn Transition Feature Properties Dialog Box

Reviews or changes general, configuration, cross-sectional, and part properties for the turn transition feature in the duct run.

See Also
Configuration Tab (on page 98)
Relationship Tab (on page 104)
Cross Section Tab (on page 99)
General Tab (Duct Turn Transition Feature Properties Dialog Box) (on page 114)

General Tab (Duct Turn Transition Feature Properties Dialog Box)

Duct Run

Defines the duct run to which the transition is assigned.

Material

Defines the material from which the transition is manufactured.

Thickness

Defines the thickness of the transition material.

Insulation Material

Specifies the material of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Material** box. However, if **Insulation Specification** is manually defined, you can select the insulation material to use. If **Insulation Specification** is a selected reference data insulation

specification, the software reads the material from the insulation specification as defined in the reference data and displays it here.

Select **More** to select an insulation material from the Catalog. To change the options on the list, edit the **Insulation Material** select list in Catalog.

Insulation Thickness

Specifies the thickness of the insulation. If you selected **Not Insulated** in the **Insulation Specification** box, you cannot change the information in the **Insulation Thickness** box. However, if **Insulation Specification** is manually defined, select the insulation thickness from those values allowed for the material in the reference data. If the value in the **Insulation Specification** field is a selected reference data insulation specification, the software reads the thickness from the insulation specification from the reference data and displays it here.

Type

Defines the type for the turn transition. The list displays the turn transitions allowed for the current specification.

Throat Radius

Defines the throat radius dimension for the turn transition. If you change the throat radius, the software automatically updates the bend radius multiplier. The list displays the last ten radii used.

Bend Radius Multiplier

Defines the turn radius that the software will use for turns while routing as a multiplier function of the duct dimension in the plane of the turn. The dimension used is the diameter for round cross section, the width dimension, or the depth dimension, depending upon the plane of the turn. If you change the bend radius multiplier, the software automatically changes the throat radius value.

The list displays the last five values in numeric order. If this is the first time in the session file, the **Bend Radius Multiplier** is the default from the active specification.

Angle

Displays the angle of the turn transition. You cannot change the angle.

Number of Vanes

Defines the number of vanes used for branches during routing. To add the weight and center of gravity of the branches vanes in the branches feature calculations, assign the values for the duct material and thickness of the branches feature as the values for the vane material and thickness equals (that is, these values are equal). The range of values for **Number of Vanes** includes non-negative integers.

Vane Length

Defines the length of the specified vanes.

Duct Component Properties Dialog Box

Allows you to review or change properties that relate to configuration, definition, occurrence, connections, relationships, notes, and weight and center of gravity parameters for components in the duct run.

See Also
Configuration Tab (on page 98)
Definition Tab (on page 101)
Occurrence Tab (on page 102)
Notes Tab (on page 101)
Relationship Tab (on page 104)
Connections Tab (Duct Component Properties Dialog Box) (on page 116)

Connections Tab (Duct Component Properties Dialog Box)

Displays the connection information for the object, the properties and their values, as defined in the reference data. For more information about the information defined in the reference data, see the *HVAC Reference Data Guide* available from the **Help > Printable Guides** command in the software.

Connector

Defines the connector for which you are viewing properties.

Select Duct Run Dialog Box

Displays all existing duct runs so you can select the duct run you want.

NOTE The **Look In** options are currently only available for **Quick Route** ⊬⊢.

Look In

Specifies where you want to look for the duct run.

- **Workspace** - Displays all duct runs placed in the defined workspace only.

- **Database** - Displays all of the duct runs available in the entire model database.

See Also
Quick Route (on page 71)
Route Duct (on page 20)

Select System Dialog Box

Provides a list of all defined duct runs.

Look in

Defines the location to search for the duct run. Select **Workspace** to look for the duct runs that exist only in your defined workspace. Select **Database** to look for the duct run in the entire Model database.

Glossary

abstract part

A part that is only defined by a partial specification and that cannot be materially provided by the organization that defines the specification.

Active Template Library (ATL)

Set of class templates and wizards supplied with Microsoft C++ Version 5.0 and later. You can use an ATL when you create ActiveX controls and any other type of object that uses the Component Object Model (COM) model. Using an ATL is generally preferred over Microsoft Foundation Classes (MFC), because the implementations are smaller, easier to use, and more closely tied to the COM model.

actuator

A device used to operate a valve using electric, pneumatic, or hydraulic pressure.

angle

The circular measurement taken from the intersection of two pipes at a turn or branch.

approval state

Recorded state of acceptance of information contained in objects within the database. The approval states indicate a level of confidence in the information stored in the database and govern your ability to alter specific data about a product.

arrangement (accommodation)

Those components of a system arranged in three-dimensional space with accurate dimensional representation for installation. Various types include electrical, HVAC, machinery, outfitting, and piping.

arrangement (HVAC)

Components and ductwork of a ventilation system arranged in three-dimensional space with accurate dimensional representation.

attribute

A single type of non-graphics information that is stored about an object such as diameter or end preparation.

axis

An imaginary line used to define the orientation of a system or object normally defined in terms of an x-, y-, and z-axis. Some 3-D graphic objects have an associated axis used to define the center or axis for rotations.

basic design

Engineering definition of the model and its systems.

bill of material (BOM)

Hierarchical decomposition of a product into constituent assemblies and parts. Specific types of BOMs exist (for example, an EBOM is a bill of material from the point of view of an engineering department; an MBOM is a bill of material from the point of view of manufacturing).

bulkload

The process by which reference data in Microsoft Excel workbooks is loaded into the Catalog database.

catalog

Repository of information about components and materials used in construction. When you use catalog parts in the model, the software places an occurrence of the catalog part in the project. This occurrence is a copy of the actual catalog part.

Catalog database

The database that contains the reference data. Each model database can reference a different Catalog database.

chain

A set of continuous and tangent segments.

change history

Process of recording information such as who, when, and why for any given modification.

change management

Software features or manual procedures for managing the consequence of change. For example, software can support a change management feature to report drawings that need updating as a result of a change in a 3-D model.

change propagation

Ability of the software to intelligently modify dependent design information to reflect change in a higher order object.

class

Grouping of individual objects that share some very significant, common characteristics.

classification folder

A folder in the Catalog hierarchy that contains part classes. Classification folders are one level above part classes. The ClassNodeType and R-ClassNodeDescribes sheets in the Microsoft Excel workbooks define the classification folders.

codelist

A set of acceptable values for a particular property that can be referred to by an index number or selected in a combo box. For example, the codelist for the material specification allows you to select from a set of standard entries, such as ASTM A183-F316 Stainless Steel.

commodity code

A user-defined code that provides an index to parts in a catalog.

commodity item

A standard component found in a manufacturer catalog (an off-the-shelf component).

component

Physical part that a feature generates.

concurrent access

Ability of the software to allow multiple users to simultaneously access and modify the design of a model.

consolidated tasks

A collection of tasks run in batch. For example, the software allows you to extract a set of drawings immediately or to schedule the batch extraction for a future time.

constraints

A logical restriction that controls how part symbols ports relate to each other and to reference ports. There are four constraints: parallel, perpendicular, coincident, and distance.

contract

A Work Breakdown Structure object representing a scope of work, usually performed by an external supplier. The contract is related to a project and appears in the Work Breakdown Structure hierarchy.

coordinate

The location of a point along the X-, Y-, or Z-axis.

coordinate system

A geometric relation used to denote the location of points in the model. The most common coordinate system is the rectangular coordinate system, whereby points are located by traversing the X-, Y-, and Z-axes of the model. Normally, coordinate systems have their origin defined as 0,0,0.

cutting plane

A plane that cuts through an object.

damage records

Data relating to the damage and repair of structure or components that occurred during or after construction of a plant.

data interchange

Capability to output the design, or portions of the design, in a standard format for use or movement to another computer software system.

database

Repository for the product model data. The database contains information to describe individual objects in the data model and the relationships between objects as appropriate.

database backup

Process of recording a backup copy of the complete database or the incremental changes after the date that the last complete copy was created.

database break and recovery

Utilities used to restore a database after files are corrupted.

database copy

Functionality to copy large collections of model objects from one design project to another design project.

database management

Functionality related to managing a product model database.

database monitor record

Transactions that occur in order to provide database (DB) recovery after a stop in response with a minimum of lost data.

degree

The highest polynomial factor in the curve or surface mathematical definition. A line is a degree 1 curve, while a cubic B-spline is a degree 3 curve.

design alternative

Difference in a design represented by a separate version. A design alternative can be a new design prepared as a proposed change, or one of several elective options that the builder or customer selects. Each design alternative has an identification assigned so you can uniquely refer to the design alternatives.

design approval log

Record of review and approval of parts of the design.

design data auto input

Automation in loading existing design data into a new design database.

design documents

Drawings, sketches, material lists, procedures, and so forth that are generated during the design phase.

design object

Any object with properties that you can select. A design object can be related to one or more contracts of different types, but related only to one contract of a given type.

design progress check

Analysis of the content of the design to some metric unit that gives an idea of the degree of completion.

design review

Functionality to support rapid viewing of the design and markup of features with comments.

design service

Any general system services related to the design function.

design standard

Feature or object used in plant design that has been determined to the normal or approved way of accomplishing a design requirement. In the context of computer software, the term refers to computer functionality to support standards, not the standard itself.

detail schedule

Lowest level of schedule used to manage and track work progress.

distributed systems

Systems consisting of sequential parts with a distributive characteristic (for example, pipes distribute fluids, HVAC distributes air, cabling distributes power, and structure distributes loads).

distribution systems

Term synonymous and used interchangeably with the term distributed systems.

documentation

Drawings and other records that you must produce to document, obtain approval, or build the design.

drawing tool

Tool that helps in the process of creating, modifying, or manipulating objects. Examples are PinPoint and SmartSketch.

easting

A term that describes an east coordinate location in a coordinate system.

edge

A topological object that represents a trimmed curve bounded by a start and end vertex.

edge distance

The distance from the center of a bolt or rivet to the edge of a plate or flange.

equipment catalog

Catalog of equipment geometry and limited properties that the software uses to identify and visualize equipment and its placement in the model. The catalog is not the source for the total specification and ordering data for the object.

fabricate

To cut, punch, and sub-assemble members in the shop.

face-to-face

The overall length of a component from the inlet face to the outlet face.

fasteners

Bolts and rivets used to connect structural members.

feature

A logical collection of parts driven by the piping specification. There are four basic features: straight, turn, branch, and inline component.

element

Primitive geometric shape such as a line, circle, or arc.

fence

Boundary or barrier that separates or closes off an area. To surround or close like a fence.

field adjustment

Material added to the neat design geometry of piping or structural parts to allow for fit up in the case that extra material is required due to uncontrolled variance in the manufacturing and construction process.

flavor

A different variation of a symbol. Each variation has different occurrence property values.

focus of rotation

A point or line about which an object or view turns.

full penetration weld

A type of weld in which the weld material extends through the complete thickness of the components being joined.

function points

Part of the requirements documentation, function points are the smallest granularity of a requirement statement that describe specific detailed actions that the software performs.

functional block diagram

Schematic representation of a system (piping, electrical, ventilation) showing system parts and their relationship. You use symbols to represent equipment and components. A connecting network of lines illustrates their relationship. Taken together, the symbols and the network illustrate the function of the system.

furnishings

Parts such as movable articles and fittings that normally are not associated with a system (for example, a chair).

generic specific

Object that is parametrically defined or defined to suit a family of specific parts (for example, International Standards parametrics). For example, a 100 - 200 gpm pump in the catalog can provide a general shape to appear in the model until a specific object has been identified. See also specific and specific object.

GUIDs

Acronym that stands for Globally Unique Identifiers. The software automatically creates the GUIDs sheet in the Excel workbooks when you create the Catalog database and schema. The purpose of storing GUIDs within Excel workbooks is to help you keep track of what has been loaded into the database. Storing GUIDs also helps to avoid the situation in which a replacement Catalog database causes existing models to become invalid.

host location

The first location created for a Site. This host location is defined when the Database Wizard creates the Site database.

host server

The database server on which the Site database was created using the Database Wizard. Alternatively, if it is a restored database set, the Host Server is the database server where the Site database is restored. The Host Server in a Workshare environment contains the origin for the Site, Site Schema, Catalog, and Catalog Schema databases. Consequently, most Project Management and reference data work must take place at the Host.

HVAC

Acronym for heating, ventilation and cooling. This system is the distribution system design for heating or cooling.

HVAC analysis

Analysis routines that address heating and cooling loads required for the compartments and that size or evaluate ventilation ducts and blower requirements.

initial design

Early stage of design work, generally before contract, used to estimate construction costs and provide a rough concept of the intended plant. Contains information relating to a plant created during its initial (concept) design period.

initial structural plan

Principal structural plan for the plant; also called a construction profile.

inline

A term used to refer to those piping components that can be inserted in a pipe feature.

instantiation

Occurrence of a catalog object at a specific geometric location in the model.

interference checking

A process that identifies possible collisions or insufficient clearance between objects in the model.

job order

Industrial authorization for accomplishing work; synonymous with a work order.

kinematics analysis

Analysis of mechanical motion.

ksi

Kips per square inch.

leg length analysis

Preferred term is welding length analysis.

library

Resource of reference information that you can access in developing a plant design.

life cycle database

Information developed to assist in the maintenance and modernization of delivered plants.

link

Way to store information about another file in your document. You can update a link so that changes in the file appear in your document.

lintel

A horizontal member used to carry a wall over an opening.

load group

A grouping in which all components feature uniform load limits and stress safety characteristics. For example, if a pipe clamp from load group 5 has a maximum nominal load of 20kN, then so does a threaded rod from load group 5.

location

A Location is defined by three user-defined inputs: 1) a unique name, 2) a unique name rule ID, and 3) the server where the Site databases reside for that Location. A Location is defined and created when the Site database is created using the Database Wizard. Additional Locations can be created in the Project Management task. Each Location is a Site-level object, thus other Plants within the same Site collection can use the Locations when the Plants are configured for Workshare.

logical member

An object in the model used to represent the design topology.

machinery

Major pieces of equipment installed in a plant.

macro

A sequence of actions or commands that can be named and stored. When you run the macro, the software performs the actions or runs the commands. You can create the macros in Visual Basic or other OLE-aware programming applications. Some of the other OLE-aware programming applications are Visual Basic for Applications, Visual C++, and so forth.

maintenance envelope

A rectangular box around the part for clearance during maintenance operations.

maintenance records

Records of breakdown, repair, and overhaul of equipment.

material analysis

Analysis of a completed design work for extracting detailed material requirements; also called material lists.

material list

An option category that controls the format and content of the bill of materials.

methods

Objects in the database that describe the manufacturing methods to the component parts of a plant.

move from point

Starting point for an action. For example, when you move an equipment object, the Move From point determines the point of origin for the move.

move to point

Ending point for an action. For example, when you move an equipment object, the Move To point determines where you want the move to stop.

MTO neutral file

A non-graphic output file that can be fed into a material control system. MTO stands for Material Take-Off.

node

- One of the set of discrete points in a flow graph.
- A terminal of any branch of a network or a terminal common to two or more branches of a network.
- An end point of any branch or a network or graph, or a junction common to two or more branches.

northing

A term that describes a north coordinate location in a coordinate system.

nozzle

A piping connection point to a piece of equipment.

nozzle standout

The shortest allowable distance between the connection point of a nozzle and the start point of a turn on the leg connected to the nozzle.

NPD (Nominal Piping Diameter)

The diameter of a pipe.

object

A type of data other than the native graphic format of the application.

occurrence (of part or equipment)

Instantiation of a part of equipment in the model that refers to the part library; an instance of a specific object. The design can be built several times, and therefore the occurrence can apply to more than one hull. Typically, an occurrence points back to a specific object, either for its complete definition, as in the case of a particular valve, or for its made from material, as in the case of a steel plate part cut from sheets. Thus, when a designer selects a component from the catalog and places it at a location in the space of the plant, the software creates an occurrence of that object in the plant design.

occurrence property

A characteristic that applies to an individual object in the model. Occurrence properties are designated with 'oa:' in the reference data workbooks. You can view and modify occurrence properties on the Occurrence tab of the properties dialog boxes in the software. Depending on the object, some occurrence properties are read-only.

origin

In coordinate geometry, the point where the X-, Y-, and Z-axes intersect.

origin point

The point at which the coordinate system is placed, providing a full Cartesian coordinate system with positive and negative quadrants. Points are placed at coordinates relative to the origin point, represented by the X, Y, and Z values.

orthogonal

The characteristic of an element consisting completely of elements positioned at 90-degree angles. A square is an orthogonal element.

orthographic

A depiction of an object created by projecting its features onto a plane along lines perpendicular to the plane.

P&ID

Diagram that shows the topology, functional components, and special requirements of a piping system; generally represents the engineering design of the system.

package

Set of closely related classes. (UML)

painting

Computation of paint surface and recording of paint system requirements.

parameter

A property whose value determines the characteristics or behavior of something.

part class

A group of similar objects. You can define part classes in the Excel workbooks. A part class can have multiple parts. For example, a heat exchanger part class can contain heat exchangers with different dimensions.

part number

Unique identifier of a part.

parts

The physical components that comprise a feature and are generally selected by the software. For example, the flanges, gaskets, and the gate valve itself are examples of the parts comprising the gate valve feature.

PDS (Plant Design System)

A comprehensive, intelligent, computer-aided design and engineering application for the process, power, and marine industries. PDS consists of integrated 2-D and 3-D modules that correspond to engineering tasks in the design workflow.

PinPoint

Tool that allows you to place, move, and modify elements with precision, relative to a reference point.

port

A connection point to a pipe or a component such as a valve.

principle of superposition

The principle that states that the stresses, strains, and displacements due to different forces can be combined. This principle is only valid for linear analysis.

Product Data Management (PDM) System

Software intended to manage both product data and documents associated to the product data. Functionality typically includes: object-based data modeling tools, user administration, business rules, and document management. Document management typically includes document editing or reviewing, document mark-up or redline, document storage, and full-text retrieval.

product structure

Hierarchical breakdown or decomposition of a product into constituent parts, volumes, or units. (For example, a bill of material is one possible type of product structure.)

production planning

Functionality associated with the work breakdown and sequence of the construction of a plant.

promotion

Process of associating approval state with a product version. A product version begins its existence at a working approval state. When the version is at some level of maturity, its approval state is elevated to a higher approval state (that is, promoted). Then, further changes must be carefully controlled and generally require the data set demoted to a working state. One or more promotions can occur successively higher approval states (between working and approved) to represent various intermediate levels of review or progressive approval.

query select sets

Set of objects that are selected in a query or queries on the database.

reference data

The data that is necessary to design plants or ships using the software. Reference data includes graphical information, such as symbols. It also contains tabular information, such as physical dimensions and piping specifications.

resource estimation

Rough estimate of material, manpower, and facility utilization for the design and construction of the plant.

route

1) A line connecting a series of points in space and constituting a proposed or traveled route. 2) The set of links and junctions joined in series to establish a connection.

satellite server

The database server where the replicated databases reside for Workshare. The Satellite Server is not used unless Workshare is activated.

schema

A database that creates the structure of another database. For example, a schema specifies the queries, tables, fields, and data types in a database.

schema update utility

Functionality used to assist in processing existing product models to an updated database structure after you modify or add to the database structure.

site

The top level in the Project Management hierarchy. A Site configuration may contain several Catalogs, each shared by multiple Plants.

site administrator

Person responsible for managing the standards and general parameters for a given plant site within a Site database.

site setup

Functionality associated with establishing a new plant site or hull for design development.

sketch and trace

User interface for rough definition of a required design feature that typically works in a 2-D mode.

sleeve

A part that connects two pipes or two ducts, for example. A sleeve can be used to prevent water from leaking through a hole.

specifications

Contracted requirements for the plant.

stud

A bolt, threaded on both ends, used to connect components.

suspended floor

A concrete floor system built above and off the ground.

symmetric node

Type of vertex on a curve. A curve with a symmetric node has the same curvature on each side of the node. A handle can be attached to a symmetric node for editing.

system

A conceptual design grouping that organizes parts in hierarchical relationships. A system represents a functional view of the model and includes information such as system name, type, properties, and design specifications for the objects assigned to the system.

tag number

User-specific, unique number assigned to an object (for example, CV-101 for a control valve, HE-2002 for a heat exchanger).

target point

The origin for coordinate measurements displayed by PinPoint. You can position the target point anywhere on the drawing sheet or view.

tolerant geometry

A type of ACIS geometry - either an edge or a vertex - that is outside the tolerance for ACIS and requires special handling.

trimmed surface

A surface whose boundary is fully or partially inside the "natural" geometric definition of the surface. Some or the entire control polygon extends outside the face boundary.

trunk

Feature that quickly reserves space for the distributive systems and other systems that have a path. Along the trunk are stations that define the cross section and identify part or system membership.

unit/module modeler

Facility of the system to structure collections of equipment and components into a single identifiable object.

user attributes

A customized property in the reference data. The Custom Interfaces sheets in the Excel workbooks define these properties. You can list the customized properties on the individual part class sheets.

version control

Ability of the system to manage multiple versions of a single part of the design. Version control should support conditional analysis and promotion status, as well as alternate design features among hulls within a plant site.

vertex

A topological object that represents a point in the three-dimensional model.

viewset

Set of objects (usually a subset of the entire database) that a view operation uses. Membership or lack of membership for any object in a view-set does not affect the actual stored representation of the object, but only its availability or desirability for viewing in the current scenario.

weight and CG analysis

Routines that compute the weight of commodity materials as configured in a given design (for example, plate and pipe) and determine total weight and center of gravity (CG) for a collection of material and equipment, as well as the complete plant.

welding

Weld requirements for joining materials. Welding length analysis is the calculation of required weld dimensions; also called leg length analysis.

wirebody

A topological object that represents a collection of edges jointed at their common endpoints.

wizard

Software routine attached to an application that provides guidance and expert help to you to complete one of the functionalities of the application.

work content

Estimation development of metrics from the database that relates to the work hour content of the various construction units.

work order

Plant authorization for completing work; synonymous with a job order.

working plane

The available 2-D plane of movement for endpoint selection.

workset

Set of objects (usually a subset of the entire database) used in an interactive change, add, or delete operation. Membership or lack of membership for any object in a work-set does not necessarily affect the actual stored representation of an object. However, you can change or delete an object in a work-set that also results in a change or deletion of the stored object. Similarly, when you add a new object (not currently stored) to a work-set, the software also adds the object container.

workspace

Area that represents the portion of the model data needed to perform the intended task and includes the user modeling settings.

workspace document

Document into which you can extract a portion of the model data for a user task.

Workspace Explorer

Tree or list representation of objects in your workspace.

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